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Rainer Brömer

Plastidules to Humans



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Leopoldo Maggi (1840-1905) and Ernst Haeckel's naturalist philosophy in the Kingdom of Italy
With an edition of Maggi's letters to Ernst Haeckel

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Introduction

The configuration of today's scientific disciplines occurred, to a large extent, during the "long nineteenth century", from the French Revolution to World War I. The Natural Philosophy of Enlightenment gave way to Romantic *Naturphilosophie*, and Napoleon's expansive wars of the dawning nineteenth century helped to spread ethnocentric nationalism across Europe and into the Middle East. With the emergence of the professional scientist during the middle third of the century, however, the pendulum swung back, away from metaphysics and holism towards a relentlessly reductionist positivism, in turn to be challenged (largely unsuccessfully) by neo-idealist and "monist" approaches in the latter third of the century, especially in the centre of Europe. Intellectuals' ambitions to play a leading role in shaping the post-Napoleonic world were frustrated, first during the Metternich restoration and then, again, in the abortive uprising of 1848 (Chadwick 1975/1990). And yet, in some sense scholarly and empirical efforts, responding to the perceived demands of the times, did in turn impact upon social and political developments, particularly among some of the "nations" which either had no state of their own (e.g., the Orthodox, Greek-speaking population in the Ottoman Empire) or lived divided between different states, constituting the majority population in some and a minority in others, such as the Italians and Germans.

Professors of various humanistic as well as scientific disciplines were eager to enlist in the ranks of militants fighting for national unity: linguists developed

organic models of language evolution, from William Jones' founding of Indo-European Studies in the 1780s to August Schleicher's genealogical trees which would later, after Darwin's *Origin*, inspire Ernst Haeckel's phylogenetic trees of the realms of living organisms.[1] Once new "ethnic" states came into being, life scientists and academic physicians endeavoured to establish the physical unity of politically united people – "Now that Italy has been created, we have to make the Italians" Massimo D'Azeglio (1798-1866) is said to have declared at the official foundation of the *Regno d'Italia* in 1861.[2] Anthropologists and ethnologists were eager to comply – notably, Cesare Lombroso (1835-1909), who later founded the discipline of "Criminal Anthropology", Paolo Mantegazza (1831-1910), and from the 1890s, the philosopher-turned-anthropologist Giuseppe Sergi (1841-1936).[3] The Italian case is particular in several ways, notably due to the presence of the Pope, whose secular possessions effectively had split the Peninsula in half, leaving no overland connection between the Bourbon kingdom of Naples (since the Vienna congress in 1816, the *Due Sicilie*) and the northern states.[4] In the ensuing conflict between the *Regno* and the *Patrimonium Petri*, scientists readily found themselves on opposing sides of the ideological battles in mid-century, a prime example being the struggle over the creation or spontaneous generation of life and, slightly later, the origin of species and, most polemically, the descent of Man.

The career of Leopoldo Maggi, spanning the first half-century of the *Regno*'s existence, offers a striking example of the multifaceted roles biology took on during the concluding stages of the *Risorgimento*, the "resurrection" of Italian national unity. His entire life, with the exception of rather few journeys, was spent in a single region of Italy, Lombardy, which was situated at the core of the events leading to the *Unità*. When Maggi enrolled as a student at the university of Pavia in 1857, the institution was still under the government of the Habsburgs; by the time he graduated with two doctoral dissertations in 1863, Lombardy had been under the control of the Savoy for almost four years (following the treaty of Villafranca) and part of the Kingdom of Italy for two. It has to be remembered that intellectuals from Milan had played a leading role in the *Risorgimento*, and Pavia provided their academic education, as Milan did not have a full university before the advent of Fascism. Therefore, Pavia was at the very centre of the revolutionary and nationalist movement which through bargaining, persuasion, and often conquest "created Italy" (D'Azeglio). The university had been one of

1 Koerner (1987); Richards (2008):125f. and *passim*.

2 The popular quote "Fatta l'Italia, bisogna fare gli italiani" is apocryphal. The attested version in his posthumous memoirs (*I miei ricordi*, ca. 1867), "pur troppo s'è fatta l'Italia, ma non si fanno gl'Italiani", sounds far more sceptical: "Alas, Italy has been created, but Italians are not being made" (Fumagalli 1980:188).

3 Baima Bollone (1992); Landucci (1985); Correnti (1987)

4 Rudolf Lill's classic *History of Italy* (1988) remains a useful introduction into the political aspects of the Risorgimento. For the subsequent confrontation between State and Church, see Lill & Traniello (eds., 1992).

the most important centres of learning in the Italian-speaking world well before the *Unità*, and scholars from Pavia played important roles in the new state right from the very beginning. These roles included not only concrete functions, such as reorganising the social and legal systems, but also more symbolic acts, establishing intellectual control over the territory, its physical features (geological and biological), its historic and prehistoric human past and its present anthropological and ethnographic composition. Ideological battles occupied a large sector of the intellectual arena, with all the complexities of the transition of power from late absolutist monarchic regimes, more or less illuminated but still sanctioned by divine mandate, to a largely secular, constitutional monarchy. Lill and Traniello (1992) have actually applied the German notion of *Kulturkampf* to the struggle which profoundly affected the first decades of the *Regno d'Italia*.

In the field of natural history, the question of the origin of life was ideologically highly charged, given the conflict between the biblical account of a complete creation, during the world's first six days of existence, and the speculation of continued *ex novo* formation of living beings from inanimate matter, which was associated with materialism.[5] Already as a student, Maggi became involved in research dedicated to proving the spontaneous generation of microbes from sterilised organic solutions (heterogenesis), which had been developed during the years of the *Risorgimento* by pathologist Mantegazza, naturalist Giuseppe Balsamo Crivelli (1800-1874), and physicist Giovanni Cantoni (1818-1897). With his first teaching position in geology and mineralogy, Maggi soon entered into the study of prehistoric human remains, linked to a survey of the natural and cultural heritage of the *Patria*, the home territory, culminating in the creation of a homeland museum (*Museo patrio*) in his native province of Varese in 1871. Along with the symbolic appropriation of the "liberated territory" came practical requirements of economic developments in a largely rural country, which was supported by life scientists providing practical, applied knowledge to agriculture and human hygiene, and again it fell to Maggi and his students to confront some of the pressing problems caused by common but unrecognised parasites befalling humans (malaria, hookworm disease), domestic animals (silkworm pests) and crops, such as the New World grape parasite *Phylloxera*, disembarking in France in 1863, identified in Italy sixteen years later in 1879.[6] It may be seen as indicative of the Lombard naturalists' foresight that the Milan-based Royal Lombard Institute for Science, Literature, and the Arts (*Regio Istituto Lombardo di scienze e lettere*), as

5 Of the substantial literature on this complex relationship, see the classical edited volume by Brooke (1991); relevant recent collections include Ferngren (2002), Clayton (2006), and Rupke (2007).

6 Ordish (1972:172) writes that "[a]lthough the phylloxera was probably present in Italy in 1870, it does not appear to have been recognized until 1875 or to have become at all general until 1879, when it was found at Lecco and Agrate, Milan Province". The German vintners' magazine *Annalen der Oenologie* in 1875 produced maps of the spread of *Phylloxera* along the river Rhône between 1865 and 1872, see the offprint Blankenhorn & Moritz (1875), plates 1 and 2.

early as 29 July 1875, appointed a commission "to provide the best means against a possible invasion and spread of Phylloxera".[7]



Fig. 1 Leopoldo Maggi (1840-1905)

It is thus becoming clear that a biography of this particular comparative anatomist and physiologist can be set up in such a way as to yield deeper insights into the manifold ramifications of a scientist's role in a rapidly changing cultural and economic setting. In particular, Leopoldo Maggi's relevance is enhanced by two idiosyncratic aspects: He was one of the first and most coherent academic followers of Ernst Haeckel (1834-1919) in Italy, who, through various different channels, was to become the most popular foreign scientist in Italy,[8] and subsequently, some of Maggi's students were to reach influential positions in Italian zoology at the turn of the twentieth century. Therefore, Maggi represents a crucial episode in the history of Italian life sciences just prior to World War I and the Fascist takeover – which is not to say that "Haeckelism", the way Maggi promoted it, played a crucial role in the advent of Fascism, as Daniel Gasman claimed in 1998.[9] What in fact happened was that the Haeckel-Maggi "school" of comparative anatomy declined in Italy at the beginning of the century (no less than it did in Germany), succumbing to a more experimental approach in biology and a resurgence of neo-idealism in philosophy (although positivism survived in some niches well into the Fascist period).[10] It can be surmised that these contingencies eventually hindered the development of a full-fledged

7 "destinata a provvedere ai migliori mezzi contro una possibile invasione e diffusione della fillossera", of which Leopoldo Maggi was a member, alongside botanist Santo Garovaglio, naturalist Emilio Cornalia, and some others. *Rendiconti. Istituto Lombardo*, 2nd ser. 8 (1875):715.

8 On some aspects of the intellectual relationship, see Barbagli (2005). The influence of Haeckel's ideas on Maggi's work will be an ongoing theme in the present work. More generally on the role of Haeckel in Italy see Krauße (1993), Brömer (1993).

9 See Gasman (1998) and the new foreword in id. (²2004). The most recent rebuttal is in Richards (2008), a short version Richards (2007a).

10 For a critical assessment of Haeckel's morphology in early twentieth-century Germany, see his own student, Richard Hertwig (1919). The lingering on of positivism in Italy, especially in the realm of sociology, is described by Nese (1993), Garzia (1992).

biological racism under Mussolini, albeit not for want of trying.[11] Ironically, the alternative model of biology which superseded that of Haeckel and Maggi's pupils also grew out of an institution based in Italy, though fully international in structure: Anton Dohrn's *Stazione zoologica* in Naples (founded 1872), which was open enough in its organisation to support the "developmental physiologist" Wilhelm Roux as well as, later, the leading vitalist Hans Driesch.[12]

"Eclecticism" has been a label recently applied to the work of Leopoldo Maggi, a "typical little-grand man of the second half of the nineteenth century" (Lanzavecchia 2002:9). The eminent Italian historian of medicine, Bruno Zanobio has suggested that eclecticism be defined as an attempt to harmonise diverse philosophical systems, selecting those of their elements that seem more easily reconcilable; by contrast, he suggests that one might suspect Maggi to be rather "a naturalist interested in different areas of research, disciplines, and activities of research" (Zanobio 2002:17). Against these allegations, already proposed by some of Maggi's contemporaries, the present work develops an opposite interpretation, without denying the incontrovertible observations made by Maggi's former colleagues and later historians: On the following pages, the course of Maggi's academic career will be portrayed in a fine balance between synchronous contextualisation and the benefit of hindsight (not least, Maggi's own). This is by no means to espouse any form of teleology: It is perfectly obvious to the historian, as it probably was to the naturalist himself, that the various studies Maggi undertook were no start-to-finish success stories in pursuit of a pre-established research programme, far from it. Even if his and his colleagues' investigations were no ideologically disinterested, open-ended endeavours, they still had to respond to experimental results, which they and the wider scientific community were able to obtain, underdetermined as they were. And if the validation of experiments within one camp of researchers may have been to a high degree self-referential, successful if they yielded the results required for the experimenters' convictions, there was always the adversarial camp to challenge the criteria of validity established by their opponents.[13] Perhaps the single most prominent example of such a contest in the mid-nineteenth century was the spontaneous generation controversy, and it is certainly no accident that this field constituted the centre of interest for naturalists in Pavia, where Maggi made his first

[11] Mussolini's understanding of Darwinism seems to have been quite rudimentary, to say the least. See his short article on the centenary of Darwin's birth and semi-centenary of the *Origin* (Mussolini 1951 [1909]).

[12] Müller (1976). On the intricacies of Roux' use of the term *Entwickelungsmechanik*, see Sander (1991). Roux used the term "mechanics" not in a strict physical sense, but objected to the name "physiology", as physiologists were less interested in the development of form. In the mid-twentieth century, C. H. Waddington proposed the term "epigenetics" as an English translation for *Entwicklungsmechanik* (Hall 2001), which, however, would be an anachronism for the nineteenth century.

[13] On the issue of validating experiments, see, for instance, Collins (1992).

contributions to experimental research in the early to mid-1860s, at precisely the moment when an illustrious Paris audience at the Sorbonne witnessed Louis Pasteur's rather more iconic than decisive refutation of spontaneous generation in a show demonstrating sterile swan-necked bottles.[14]

But the dexterity Maggi had achieved in manipulating the "infinitely small" organisms central to the spontaneous generation research pursued at his university in Pavia later enabled him to branch out his activities into other areas, such as the classification of micro-organisms and the study of pathologies which these organisms were suspected to cause. This interest of Maggi's resulted in his creation of a long-running course in medical protistology, delivered to students from the medical faculty. Other ramifications of his initial studies included questions of organismic individuality: Was the cell, with (or without) its membrane, hyaline content, and nucleus, the ultimate unit of life, or were there smaller components, plastids, plastidules, molecules, and so forth, which ought to be considered as independent living beings?[15] These questions arose out of heterogenesis research, but their relevance was by no means limited to the realm of spontaneous generation: Rather, they were to become central to cell physiology and theories of inheritance developed in the second half of the nineteenth century – and the phylogenetic status of cell organelles remains controversial to this day, just over a century after Mereschkowsky's postulate of the endosymbiont theory (Mereschkowsky 1905).[16] According to this theory, organelles, such as the mitochondria or chloroplasts, were considered as formerly independent organisms which, at the initial stage of the development of more complex species, were "swallowed" by nucleate cells, but continued to live inside them rather than being digested, and eventually became integral parts of the functioning host cell.[17] At the other end of the scale, organisms forming inseparable colonies (as, for instance, the jellyfish group of *Siphonophora*, studied by Ernst Haeckel) also raised the question of animal individuality, an issue pursued further by one of Maggi's most successful students, Giacomo Cattaneo (1857-1925), who went on to divulge the results of his researches in a widely circulating popular manual.[18]

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14 This debate will be discussed in more detail below; for an overview of the French case see Latour (1997), on Pavia Landucci (1996:1012).

15 For an overview compiled at the time, see Altmann (1890):1-16, esp. 8f. Most recently, Reynolds has discussed this complex in three papers (2007, 2008, 2008a).

16 Konstantin Sergeevich Merezhkovsky (1855-1921); transliteration as in his German publication. The paper has been translated into English and commentated by Martin & Kowallik (1999).

17 The botanist Schimper had developed a similar concept for the origin of chlorophyll grains (*Chloroplastiden*) and other plastids (his terms) already two decades earlier; he argued that if it could be proved that plastids were not produced ex novo in the egg cells, then their relation with the organism containing them would be reminiscent of symbiosis (Schimper 1883: col. 112f., n. 2). See Mollenhauer (2007:297) for an example of the analogous process observed in an extant fungus species.

18 Systematic study in Cattaneo (1879), popularised version in a *Manuale Hoepli*, id. (1895). For a recent analysis of Haeckel's concepts of organismic individuality, see Reynolds (2008).

Compared to the step from research on the origin of life to questions about its smallest independent units, there appears to be a huge leap from protist to vertebrate anatomy. It is thus of little surprise to read, in one of the obituaries published soon after Maggi's death, that his work was articulated in relatively independent areas. We may doubt, however, that Maggi himself saw his strands of research as being conceptually separate, even though we need to be careful to avoid the pitfall of retrospective rationalisation, a temptation for the historian, but equally for the historical actor himself, eager to avoid the impression of a haphazard, opportunistic career. The early course of Louis Pasteur's work shows some parallels with that of the Pavia group. In 1922, Vallery-Radot wrote that (his grandfather) "Pasteur's oeuvre is a single unity". He continues in Louis' words: "I was entrained, or shall I say enchained, by the almost inflexible logic of my research to move on from studies in crystallography and molecular chemistry into research on fermentation".[19] Interestingly, in recent history and philosophy of science, the idea of conceptual logic driving experimental research (even below the consciousness of individual actors) has been to some extent rehabilitated,[20] though these postulates remain controversial. In the case of Maggi and members of his laboratory, the present thesis rather argues that the naturalist steered his work through the turbulent institutional conditions of the early national university, in an idiosyncratic way, certainly, responding to and creating opportunities, paying close attention to international developments in his various fields of research.[21] In his published writings, Maggi was quite circumspect, generally avoiding ideological statements, with few noteworthy exceptions, which we will encounter in subsequent chapters. The aim of the present work is to construct a sketch of the culture of natural history at a very specific historic juncture, the formation of the last large nation states in Europe, through the biography of an individual "natural historian", who through his research, academic teaching, and popular lecturing helped shape the intellectual agenda in an influential area of the new state. We will see Maggi as an integral, active part of this particular moment in history. Thus, his approach to science, eclectic or otherwise, is situated in its historic contingencies, irrespective of any qualms about later judgements of "validity" or long-term success of his findings and hypotheses.

19 "L'œuvre de Pasteur est tout unité. « Entraîné, enchaîné devrai-je dire, par une logique inflexible de mes études j'ai passé, écrivait-il en 1883, des recherches de cristallographie et de chimie moléculaire à l'étude des ferments »" (Vallery-Radot 1922 vol. 2: v).

20 E.g., Graßhoff & May (1995).

21 His colleagues are quite unanimous in portraying him as a strong-willed character.

Writing biographically

The genre of biographies in the history of science and medicine had fallen into disrepute in the period of postmodernism, when even the concept of authorship was disputed.[22] More recently, however, biographies have enjoyed a broad comeback, both in academic writing and, very noticeably, in popular publishing.[23] Contemporary, sophisticated biographies transcend the Victorian *Life and Letters* approach to famous men (usually), but they tend to do so on the basis of what has been documented in the past, even while severely criticising the criteria governing earlier work. Only when the present historian enters a field devoid of well-trodden paths from the past, are we reminded of the usefulness of our predecessors' efforts, much as we may regard those as methodologically limited and conceptually dated. In the case of Leopoldo Maggi, there is not much available to be transcended, given that neither he nor his intellectual and socio-cultural environment have had the benefit of extensive (let alone: critical) historical coverage, Royal or Republican, Whiggish or constructivist. This is quite a general problem in the historiography of Italian science, as Pancaldi (2003:56) points out when he laments, writing about early nineteenth-century physics, that "[t]he kind of fascination with biography and the 'life and letter' genre that affected Victorian Britain won few converts south of the Alps". Until fairly recently, the best overview available for Italian biology was Grassi's survey produced on the occasion of the first semi-centenary of Italy's unification (1911), which he compiled on the basis of a questionnaire he had circulated among all Italian

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22 On the "Death of the Author", see the classical text by Roland Barthes (1967).

23 We could mention, in reverse chronological order, volumes edited by Rupke (2007), Söderqvist (2007), the journal Isis (FOCUS 2006), Zigman (2006), Bödeker (2003); the academic resurgence of biography in the history of science can be traced back to the mid-1990s, with volumes such as La Vergata (1995) and Shortland & Yeo (1996). Previously, the "industrial" biographic output presenting "great scientists" had been reviewed critically, e.g. by Lenoir (1987), while more recently, this output has itself become subject to "metabiography" (Rupke 2005).

institutions of higher education in life sciences.[24] After the appearance of Grassi's hefty tome, it was not until the end of the century than new comprehensive works on Italian biology appeared, with Landucci's extensive contributions to Tort's *Dictionnaire* and Dröscher's thesis on Cellular Theory in Italy, both published in 1996.[25] The scope of these two works is very different, however: Tort's *Dictionnaire* very closely focuses on the reception of Darwinism, excluding the vast majority of life scientists, although Landucci's entry on 'Italian Darwinism' provides a far broader range of intellectual history, tracing back naturalists' pursuits in Italy well into the eighteenth century and integrating their ideas with the course of the peninsula's political history. In addition, Landucci penned over sixty individual short biographies of Darwin's Italian interlocutors, disciples, and opponents.[26] Dröscher, on the other hand, offers a thorough prosopographical study of the various communities involved in cell biological research in Italy, including the academic filiations, often from foreign "masters", thanks to a generous programme of government scholarships provided for young scientists to undertake advanced studies abroad.[27] Therefore, it seems helpful to sketch a general frame of reference, within the limits imposed by the relative scarcity of original documents, before proceeding to a thematic analysis of the major strands of Maggi's activities as a scientist who pursued his research, writing, and teaching at a very particular period of socio-cultural transition in Italy and beyond.

On the one hand, the scope of the present work is a micro-history closely linked to the life course of the subject of this biography, Leopoldo Maggi, rather than a prosopography of any of the various communities on whose territories Maggi encroached during more than forty years of his academic career, from

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24 Some of the replies are still available in the Grassi papers at the Institute for Comparative Anatomy in Rome (Cipollini 1984:122). In addition to Grassi's volume, a paper in the cultural magazine *Nuova Antologia* should be mentioned (Cermenati 1910), which placed far greater emphasis on Darwinism than the positivist, matter-of-fact chronicle proposed by Grassi. The Lombard Cermenati (1868-1924) was a professor for geology and palaeontology in Rome, later teaching history of science (Benini 1980).

25 Pancaldi's *Darwin in Italy* (1983/1991) provided a far more limited range of case studies, dealing with pre-Darwinian Lamarckism (geologist Giambattista Brocchi, ornithologist Carlo Luciano Bonaparte), Darwin's most committed Italian spokesman, the zoologist Giovanni Canestrini, the constructive criticism of the botanist Federico Delpino, and Cesare Lombroso's 'criminal anthropology'. Benasso's important series of articles (1976-1981) is really more of a collection of material, as the title expresses, and again quite narrowly focused on the idea of transmutation and evolution of species.

26 Since his case study on *Darwinism in Florence* (1977), Landucci has published a number of important studies on cultural and political aspects of Darwinism in Italy, notably his monograph on history of philosophy (Landucci 1987) and a lengthy chapter on Italian nationalism (id. 1992).

27 On the aspect of international scholarships, see esp. Dröscher (1992). Over time, the volume of this programme declined, and more Italian students availed themselves of institutions in Italy, esp. the international *Stazione zoologica* founded by Anton Dohrn in Naples in 1872 (Müller 1976).

geology to subcellular physiology, protist systematics, medical protistology, and biogenetic morphology of vertebrates.[28] It will become apparent that Maggi, while floating between different fields for a variety of reasons, drawing on and feeding into evolving institutional and intellectual networks, managed to construct some degree of coherence and unity of his unfolding activities and developing concepts, at least retrospectively. The Romantic notion of "unity" played a crucial role in the socio-cultural attitudes of post-Napoleonic Europe, and in particular in the "delayed nations" of Italy and Germany. Hence, Maggi's emphasis on unity of the living (if not the abiotic) cosmos comes as little surprise, given that he was brought up in the crucible of unified Italy: Milan and its nearest university in Pavia.[29] Despite the micro-historical, biographic layout of this thesis, on the other hand, some light will be thrown on the interaction between the branches of natural history which were right in the process of differentiation and institutionalisation, in Italy as elsewhere.[30] Nor is this interaction random, as we will see on our course along the different branches: At least from the mid-1870s, Maggi's commitment to the further elaboration of Haeckel's biogenetic law provides a continuous leitmotif for his research and teaching, for which we find solid contemporary evidence, even though Maggi himself, in 1884, sought to backdate his encounter with Haeckel's ideas to "1866, the time when [Haeckel's] *Generelle Morphologie* appeared" – a claim for which no traces can be found in his *œuvre*.[31]

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28 On the uses of prosopography in the history of science, see the classical paper by Shapin & Thackray (1974). The line between an individual biography and a prospographical study cannot be drawn precisely: Especially in the absence of previous studies in the fields in which Maggi was involved (esp. in his later work with cranial morphology), some elements of prosopography will inevitably shine through, without being followed through systematically.

29 For a general reflection on the benefit of biographical writing on Maggi, see Brömer (2006).

30 On Italy, see Dröscher (2002a), for the example of Germany, Nyhart (1995).

31 Maggi's letter to Haeckel dated January 30th, 1884, see Appendix.

Table 1: Important stages in Maggi's life and career (in Pavia, unless stated otherwise

1840	15 May born in Rancio (province of Varese)
1857	enrols at Pavia University's medical faculty
1861	appointed assistant to Paolo Panceri, work on spontaneous generation
1862	assistant to Giuseppe Balsamo Crivelli
1863	doctorates in medicine and natural history
1864	lecturer in mineralogy and geology
1869	*professore straordinario* in mineralogy and geology
1875	*professore straordinario* in comparative anatomy and zoology
1876	*professore straordinario* in comparative anatomy and physiology
1877	*professore ordinario* in comparative anatomy and physiology
1878	VII. Congress of Naturalists in Varese; in the same year, Maggi develops the concept of plastidules as basic units of life
1879	full member of the Royal Lombard Institute for Science and Letters
1888	first of two consecutive 3-year terms as Dean of the Faculty of Sciences and Mathematics
1890	beginning work on comparative morphology of the skull
1894	unable to attend celebration for Ernst Haeckel's 60th birthday
1900/01	member of the Italian Higher Education Council
1904	meeting Haeckel on the occasion of the latter's 70th birthday celebrated at the Hotel Bristol in Rapallo, Italy
1905	7 March sudden death in his summer house on the Lago Maggiore

Life and (a few) letters

Leopoldo Maggi was born on 15 May, 1840, in Rancio, a small hamlet located in the Cuvia valley (Valcuvia) near the Lago Maggiore in today's province of Varese[32], which was at the time part of the restoration Kingdom of Lombardy-Venetia, belonging to the Austro-Hungarian Empire. His father, Michele, was the public health physician (*medico condotto*),[33] scion of an established family originating from Milan, of whom the best known ancestor, two centuries earlier, was the vernacular poet Carlo Maria Maggi (1630-1699).[34] Location, time, and relations matter, as will become apparent in the unfolding of this story: At a time of limited social mobility, being born into a medical family provided a strong impulse for the choice of a similar career, which is what Leopoldo aimed at when enrolling at the university of Pavia, some thirty kilometres south of Milan, the city where he had attended school. Pavia hosted the only university in Lombardy, home at the time to one of the most venerable medical faculties teaching in Italian. Michele Maggi

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32 In fact, the province of Varese was not created until 1927; until then, Rancio belonged to the province of Como.

33 On the role of the *medico condotto*, see Forti Messina (1982), ead. (1984).

34 The scarce information on Michele Maggi available has been summarised in Contini (2002): 20 and fn. 3-4. On Carlo Maria Maggi, cf. Isella (1984:25-47); his chapter on Maggi had originally been published in 1964.

had graduated there in 1836, four years before Leopoldo's birth.[35] Thus, in 1857, Leopoldo Maggi enrolled in the medical faculty, though his colleagues later agreed that, "right from the outset, his intentions were scientific rather than practical":[36]

> *The spirit of observation, a passion for the beautiful and the true, a fine artistic taste, and the not insignificant aptitude for drawing would have led him directly to natural sciences; but at the time, one arrived there obliquely, via medicine.*[37]

While it is hard to assess these comments, expressed half a century after the event, it seems very much worth noting that the Goethean notion of the *Schöne, Wahre und Gute*, as well as the emphasis on artistic sensibility and dexterity played a central role for the identity and perception of the German zoologist and comparative anatomist, Ernst Haeckel, whose concepts Maggi absorbed and assimilated so avidly, early on and throughout his academic career (Krauße 2001).[38]

But the "little Ancient world" of Habsburg Northern Italy, so vividly described by Leopoldo's near contemporary, Antonio Fogazzaro (1842-1911),[39] was coming to an end. The Lago Maggiore, scene of Maggi's childhood as of Fogazzaro's novel, formed the border between the Austro-Hungarian Empire on the eastern shore and the Kingdom of Sardinia and Piedmont in the west. Milan and the Alpine Lakes were centres of the Romantic political movement known as the *Risorgimento*, calling for the creation of a unitary state for the "people" of Italy, who were conceived of mainly as speakers of the Italian language.[40] In the spring of 1859, the French under Napoleon III allied themselves with the Savoy king of Piedmont, Victor Emanuel II, and set out to conquer (or "liberate", as the Risorgimento activists would say) Lombardy. In early June, the joint French-Piedmontese armies defeated the Habsburgs at Magenta, some twenty-five kilometres west of Milan, giving Napoleon access to the capital and surrounding

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35 Some information about the Maggis before Leopoldo's enrolment at Pavia has been collected by Contini (2002:20).

36 "fin dall'origine con intenti scientifici piuttosto che pratici" (Artini 1907:89).

37 "Lo spirito di osservazione, la passione per il bello e il vero, il fine gusto artistico e la non poca attitudine al disegno, se fosse stato oggi, lo avrebbero direttamente avviato alle scienze naturali; ma allora ci si perveniva di riflesso per la medicina" (Pavesi 1905:4).

38 Later in life, during (!) academic meetings of the *Istituto Lombardo*, Maggi produced numerous elaborate sketches of landscapes and rural buildings, some of which have been reproduced between the chapters of Armocida et al. (2002), pp. 14, 34, 48, 56, 66, 90, 106 &125. The original sheets are preserved in the archives of the *Istituto Lombardo* in Milan. Famously, Maggi also designed and commissioned a large series of didactic wall charts for his lectures, though only a few of them were executed by himself; see Rovati & Violani (eds., 2005): 30.

39 In his novel *Piccolo mondo antico* (1895), first of a tetralogy, followed by *Piccolo mondo moderno* (1901), *Il santo* (1905), and *Leila* (1910); on Fogazzaro, see Nardi (1938), Rossi (1977), Cavani (1992).

40 For a brief overview of *Risorgimento* mythology, see Lyttelton (2001). On the role of language in Italian identity, see Ruzza (2000).

towns, including Pavia. Leopoldo Maggi, just completing his second year as a medical student in Pavia, was then drafted at officer's rank into the French Ambulance corps, a function he retained during the Italian war of Independence (1859/60); a small but perhaps relevant detail about his commitment to the patriotic cause.[41] Three weeks after the allied victory at Magenta, the French army fought the Habsburg troops at Solferino and Sammartino, near Lake Garda. The Swiss businessman Henry Dunant witnessed the aftermath of the battle, where some 40,000 injured soldiers had been left behind after a day of fighting. The experience of the ensuing suffering led Dunant to organise an international rescue organisation, the Red Cross. In his *Memory from Solferino* (1862), Dunant drastically describes the inadequacies of the existing ambulances, oxen carts, which were few in number, gave little shelter, and moved extremely slowly from the battlefield.[42] It is entirely left to our speculation to imagine nineteen-year-old Maggi providing first aid to the victims during and after the carnage of the War of Independence, an experience of which not a hint is given in any of his writings, though in general, Maggi is never shy to sprinkle autobiographical information over his academic and semi-popular writings.

After the war, while still a student, in 1860/61 Maggi became an honorary assistant to Paolo Panceri (1833-1877), who served as assistant professor (*assistente effettivo*) to the comparative anatomist, Giuseppe Balsamo Crivelli.[43] The following year, when Panceri left for Bologna and later Naples, Maggi succeeded him as a salaried assistant professor in natural history. In 1863, finally, Maggi graduated in two disciplines, at a distance of six months, first in natural history, defending a thesis *On the circulatory system of the animals* (26 January, M1), then in medicine with a thesis *On degeneration* (26 July, M2).[44] His previous military engagement might help explain the relatively long delay of his graduations, a full six years after taking up his studies. A small autobiographical sketch, published in one of Maggi's obituaries, provides some further information about the intellectual pursuits during his student years, a period which otherwise is not well documented:

41 "Mentre era ancora studente, nel 1859, veniva addetto all'ambulanza francese col grado di ufficiale e vi rimaneva durante la guerra per l'indipendenza d'Italia". Calvi (1884): table V. This detail is curiously absent in all other biographical information, although patriotic commitment was still perfectly respectable for Italian academics in the early twentieth century, as other remarks in obituaries and reports attest.

42 On the experiences of Solferino and the subsequent campaign for the Red Cross organisation, see Müller (1897), where an abridged German version of Dunant's memoir is included.

43 Panceri himself did not have a chair in Pavia, contrary to the assertion in Barbagli (2006:351). On Panceri, see Gasco (1878), Borrelli (1990-91).

44 References to Maggi's published works are provided in shorthand, marked by the letter "M" followed by the number which Maggi assigned more or less chronologically to each of his writings in his printed publication lists (M272). A revised and updated bibliography of Maggi's works is provided after the general bibliography at the end of this thesis.

Mainly and directly my masters were the professors Giuseppe Balsamo Crivelli and Paolo Panceri; much did I learn from Bartolomeo Panizza; and Giovanni Cantoni, one of Carlo Cattaneo's colleagues, gave me the philosophical inflection of Natural Sciences. Having known Cuvier's school, in contrast to the ideas of Lamarck and of the two Geoffroy Saint-Hilaires, I found in Lyell, and particularly in the first edition of his work on Geology, an approach to the theory of transformation of the species, and the studies I did in palaeontology and geology during the first years of my teaching prepared me for Darwinism, which I accepted without any reservation. Huxley, right from his first writings, gave me an insight into the theory of evolution. Owen made me think of homologies. Daily conversations with Balsamo-Crivelli and Panceri directed me towards embryological research, through which I understood that it was necessary to study the inferior organisms, and thus the protists, and to take the lead from those not only in ontogeny but also in stratigraphic palaeontology and in comparative anatomy and physiology, and that is what I did.[45]

The list of teachers includes illustrious names and explicit references to a very broad range of currents,[46] from botany and zoology, animal physiology, and human anatomy, to the physics and philosophy of a committed activist for Italian unification, Giovanni Cantoni; worth noting is also the mentioning of Carlo Cattaneo (1801-1869), not a scientist himself (he had graduated in law), but one of the leading figures of the *Risorgimento* in Lombardy, prolific writer and editor of a highly influential periodical, *Il Politecnico* (founded in 1831), which incidentally

45 "Principalmente e direttamente mi furono maestri i proff. Giuseppe Balsamo Crivelli e Paolo Panceri; molto imparai anche da Bartolomeo Panizza; e Giovanni Cantoni, collega di Carlo Cattaneo, mi diede l'intonatura filosofica delle Scienze naturali.
Conosciuta la scuola di Cuvier, in contrasto coll'idea di Lamark [sic] e dei due Geoffroy Saint-Hilaire, trovai in Lyell, particolarmente nella prima edizione della sua opera di Geologia, un avviamento alla teoria della trasformazione delle specie, e gli studi di paleontologia e di geologia che feci durante i primi anni di insegnamento, mi prepararono al Darwinismo, che ammisi senza riserva. Huxley mi fece intravvedere, fin dai primi suoi scritti, la teoria dell'evoluzione. Owen mi fece pensare sulle omologie. I discorsi giornalieri con Balsamo-Crivelli e Panceri, mi spinsero alle ricerche embriologiche, che mi fecero conoscere essere necessario studiare gli esseri inferiori e quindi i protisti, e partire da loro non solo nell'ontegenia [sic] ma anche nella paleontologia stratigrafica e nell'Anatomia e fisiologia comparata, e così feci….." Quoted in Frassetto 1905, p. 322n.

46 Bartolomeo Panizza (1785-1867) was the leading anatomist in Pavia of the generation of Maggi's teachers (Di Gregorio 1987). The "two Geoffroys" are Etienne (1772-1844) and his son Isidore (1805-1861). See Appel (1987) for the spectacular debate between Cuvier and Etienne in the first third of the nineteenth century, which reverberated through the European intellectual world at the time of the second French revolution of 1830. Charles Lyell's (1797-1875) *Principles of Geology* were first published by John Murray in London, in three volumes, from 1830-1833. The first volume was among the books Charles Darwin read during his voyage on board the Beagle, 1831-1836. On Thomas Henry Huxley (1825-1895), a central figure in the debate on Darwinism (and also of some relevance in spontaneous generation research), see Adrian Desmond (1994-97): *Huxley*. On Richard Owen (1804-1892), see the comprehensive biography by Rupke (1994).

carried the first Italian review of Darwin's *On the Origin of Species*, penned anonymously by the editor ([Cattaneo] 1860).[47] Curiously, the name of Paolo Mantegazza is absent from Maggi's list, though the former was probably the most influential member of the group, before leaving Pavia in 1869 (well after Maggi's graduation) to take up the founding directorship of the Institute for Anthropology and Ethnology at the *Istituto di studi superiori* in Florence, Italy's interim capital, in 1870.[48] The alienation between the two scholars may well have been mutual, considering the exceedingly cool reception Mantegazza later gave Maggi's anthropological projects, culminating in an almost dismissive tone the former teacher used in the very brief obituary devoted to his student, whom he was to survive by five years (Mantegazza 1905a).

During the academic year following Maggi's graduation (1863/64), the teaching of natural history in Pavia was strengthened with the creation of a second chair: While Balsamo Crivelli focused his remit on zoology and comparative anatomy, he supported his assistant's application for the second chair, dedicated to geology and mineralogy, to which Maggi was duly appointed in October 1864, initially at the rank of lecturer (*incaricato*). The following year, Maggi married Balsamo's daughter Pierina – a young scholar becoming his professor's son-in-law was a pattern quite common not only at Pavia, but apparently throughout university history.[49] In 1869, Maggi successfully applied for a nomination as *professore straordinario*.[50] Thus began what has recently been called Maggi's "eclectic" work in mineralogy, palaeoethnography, and anthropology,[51] apparently far away from the microbiological research during his student days with Mantegazza, Balsamo Crivelli, and Giovanni Cantoni. A few cautionary remarks are in order at this point, however: As in other countries (Nyhart 1995), the 1860s were a time when, in Italy, 'biology took form'. It has been noted that, until 1864; Balsamo Crivelli had covered the entire field of natural history – at least in teaching, though in his research he had been able to concentrate on the life sciences.[52] In a (somewhat distant) analogy, Louis Pasteur started his research into the presumed origin of life from work in crystallography,[53] and similarly, the Pavia group included a physicist, Giovanni Cantoni, who contributed approaches on a

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47 On Carlo Cattaneo's role in the *Risorgimento*, see the classical work by Lovett (1972). A comprehensive survey of literature on and by Charles Darwin in Italy is provided by Coccia (2003).

48 Like Milan in Lombardy, the capital of Tuscany had kept its university at a distance, in Pisa, as was the case with Venice (Padua).

49 For a discussion of slightly earlier German examples, see Clark (2006:241f.).

50 Contini 2002:22, n.7.

51 Armocida, Contini & Vaccari (eds., 2002).

52 For a bibliography of Balsamo Crivelli's most relevant publications, see Taramelli (1883).

53 Geison (1995):53-109.

"molecular"[54] level to the anatomical (Balsamo), histological (Eusebio Oehl), and physiological expertise (Mantegazza). Once Friedrich Wöhler (1800–1882) through his success in creating (organic) urea from (inorganic) ammonium seemed to have bridged the gap between the realms of the non-living and the living (1828), chemical approaches were introduced into studies of living matter:[55] either quantitative analyses of its composition, or if structure was at all considered, elementary organisms were conceived of as crystals, not so different from the objects of mineralogical research. From this historical perspective, the range of Maggi's research may appear far less eclectic, even though it is true that some of his contemporaries were already going further down the path of a narrower specialisation, and a degree of contingent opportunism can be observed in some of Maggi's occasional publications, partly responding to intellectual and political developments in his environment, partly arising out of his duties, among others, as director of a museum and cabinet of comparative anatomy (and physiology, as he later added to its name and remit; see M97).

His position as a lecturer gained Maggi admission to the prestigious Italian Society for Natural Sciences (*Società italiana di scienze naturali*). The proceedings of this society published Maggi's first major research, examining the annelid genus of Aeolosoma (M4), a paper which made him more widely known in the field of zoology. This was however not the area he continued to cultivate. In the next few years, he became more actively involved in the Pavia group's experiments concerning the origin of life through spontaneous generation from inanimate organic solutions ("heterogenesis"), a thread he continued to pursue across the stormy debates stirring the various concepts of cellular and plastidular theories, well into the twentieth century (Farley 1977). Early on in his career, Maggi came across Ernst Haeckel's recent exhaustive (and to many, exhausting) system of a *General Morphology of the Organisms*.[56] While Balsamo was reluctant to delve into the immense wealth of Haeckel's neologisms, Maggi adopted the German zoologist's system wholeheartedly – in particular, the realm of "protists", which Haeckel had postulated, alongside the traditional animal and plant kingdoms, not unlike the *règne des psychodiaires* introduced in 1824 by Jean Baptiste Bory de Saint-Vincent (1778-1846).[57] 'Bible' and 'Gospel according to Haeckel' are terms used, the former by Maggi himself, the latter, with an ironic slant, by his colleagues, gently (or not so gently) scolding the Lombard anatomist for his, at times proselytising,

[54] It is crucial to note the distinctive use of the term "molecule" in early-nineteenth century life sciences, compared to concepts in chemistry (Strick 2000:6-10).

[55] Haeckel discusses the role of Wöhler's discovery for the theory of autogony in his *General Morphology* (1866 1:189); see also Richards (2008):138.

[56] (Haeckel 1866). We do not know precisely, when; the first explicit quotes in Maggi's work are not to be found until eight years later, in 1874. His response to Haeckel's work will be discussed below.

[57] See Bory de Saint-Vincent entries in Audouins's *Dictionnaire classique* (1825, 1828). An Italian translation of the *Dictionnaire* was produced in Venice between 1831 and 1843.

reliance on the work of his mentor from distant Jena, whom he did not meet in person until Christmas 1903, little more than a year before Maggi's death, despite the fact that Haeckel undertook almost annual journeys to Italy.[58]

The appointment as extraordinary professor for mineralogy and geology in 1869 facilitated Maggi's election as a corresponding member of the *Istituto Lombardo*. For the rest of his career, Maggi remained most closely linked to this academy, as an active contributor both to the Institute's activities, such as organising research commissions on specific urgent topics, and to their publications, the proceedings (*Rendiconti*) and memoirs (*Memorie*). In many respects, Maggi was remarkably constant: From the surviving records, it seems he hardly ever travelled beyond Lombardy and the immediately neighbouring regions. His research concerned geological formations, organisms, and objects found in this limited area, which he studied assiduously. Therefore, especially in the decade of his appointment in geology and mineralogy (1863-1874), he spent almost every break on excursions in the mountains, but always covering one well-defined area, between the Lago Maggiore and the Swiss border. Even his publications, with very few exceptions, appeared in the local periodicals of the *Istituto Lombardo*, the *Acta* (*Atti*) of the *Società italiana di scienze naturali* (both published in Milan), and summaries in his own bulletin (*Bollettino scientifico*), which he edited from 1879 until 1899, together with two colleagues from Pavia, Achille De Giovanni (1838-1916) and Giovanni Zoja (1833-1899).[59] The one long-distance trip to be documented, at this early, decisive stage of his career, led him to Catania in Sicily,[60] for a meeting of the *Società italiana* in 1869. On the occasion, two local scientific academies of some renown made him a corresponding member: the *Accademia Gioenia* of Catania and the *Accademia degli Zelanti di Aci Reale*; however, it does not seem that Maggi followed up on these contacts: Neither did he publish in these academies' journals, nor did they carry obituaries after his death. It seems that he became progressively more sedentary: For his protistological research, he still travelled quite widely in the Alps, whereas his work in craniology did not require much journeying, except for occasional visits to other museums,[61] the commutes to Milan for meetings of the *Istituto Lombardo*, and of course recreational trips to his house in Germignaga, on the shore of the Lago Maggiore, and, finally, a

58 Krauße (1993). For some reason, Maggi failed to attend the celebration for Haeckel's sixtieth birthday (16 Feb. 1894), which some of his colleagues had organised in Genoa; see his letters to Haeckel dated 8 Jan. and 22 March 1894, transcribed in the appendix.

59 Landucci (1996:1010) reminds us that in mid-century, few specialised journals were available for Italian naturalists – but towards the end of the century, this situation had changed very significantly, without Maggi taking advantage of these developments. On De Giovanni, see Dini (1996), on Zoja, see M258.

60 Apart from travelling extensively for his research in Lombardy and Veneto, he also attended the 25th anniversary of the Zoological Station in Naples in 1897 (M234).

61 For an excursion to Genoa in 1903, see M276.

number of ministerial committee meetings in Rome.[62] The high degree of geographical constancy appears quite remarkable in comparison to other scientists of his own generation, while it had not been so uncommon only a generation earlier, as in the case of the eminent anatomist in Bologna, Luigi Calori (1807-1896), who had been born in the province of Bologna, graduated from the town's medical school, and, after a brief interlude as an anatomy teacher at the Fine Arts Academy in Bologna, held the chair for human anatomy at his alma mater for some fifty-two years, until his death at the age of eighty-nine (Armocida 2007:26f.).

At the beginning of his academic career, Maggi became more involved in the study of natural and human history in his native zone of Varese. After the recent discovery of prehistoric lake dwellings (*Pfahlbauten*) in Switzerland, similar finds came to light on the shores of the Italian Alpine lakes.[63] The study of Italy's classical history and pre-history after the foundation of the Kingdom was to a substantial degree fuelled by patriotic fervour. Droves of amateurs went out into the countryside in search for evidence of past glories as a foundation for future identity, and local museums were organised by enthusiasts, often under the programmatic name of *Museo patrio* (Fatherland Museum).[64] When this happened in his home area of Varese in 1871, Maggi liberally devoted a considerable amount of work to the setup of the museum, examining scientifically several of its exhibits, and offering advice as to the most up-to-date layout for their presentation. After all, he was deeply absorbed in the running of the anatomy museum at his own institution, the *Museo e gabinetto di anatomia comparata*,[65] and therefore well versed in the practice of museology. Thus, the first half of the 1870s saw Maggi's activities equally divided between the experiments on heterogenesis with his colleagues in Pavia, and the mineralogical and palaeoethnological survey of the Varese landscape. On the former subject, he published his first monograph in 1874, *On the natural history of inferior organisms (infusorians)* (M45), while in the latter field, he contributed a chapter 'On the geological constitution of the Varese territory' (M44), published in the *Descriptive Guide to Varese and Its Territory* by Giulio Cesare Bizzozero in the same year (Bizzozero 1874:9-46).[66]

Towards the end of this fruitful year, a rather more sombre event secured Maggi's further career: On 15 November, 1874, his erstwhile supervisor and by

62 Thus, he was present at a full meeting of the Public Education Council in Rome, at least once, on 10 Nov. 1900 (Ciampi & Santangeli 1994:197). He also mentions a committee meeting to be held in Rome in a letter to Haeckel dated 12 Apr. 1889.

63 Munro (1890), on Italy esp. 'Third Lecture', pp. 186-276.

64 Basso (1990).

65 Barbagli & Rovati (2002).

66 The surging interest in local natural and cultural history became manifest in the publication of yet another, two-volume compendium of information on Varese, which also drew extensively on Maggi's geological work (Brambilla 1874, *passim*).

then father-in-law, Giuseppe Balsamo Crivelli, suddenly died, at the age of seventy-four. Maggi took over his deceased master's academic duties, initially on a temporary basis, not only the teaching of zoology and comparative anatomy, but also the role of acting director of the anatomy museum. Over the following months, while the appointment procedure for Balsamo's successor were underway, the education ministry decided another division of the former natural history chair: comparative anatomy and physiology were separated from zoology, and while Maggi was now permanently appointed to cover the former, Pietro Pavesi (1844-1907), at the time teaching in Genoa, took on zoology (Landucci 1996:3386), and Torquato Taramelli from Udine succeeded on Maggi's previous position in mineralogy and geology.[67] With the termination of his six-year diversion through the mineral realm, Maggi had now attained a permanent position in the life sciences, and with his promotion to a full professorship two years later (1877), he had reached the final academic position, where he would stay for the remaining twenty-eight years of his life. Therefore, his entire career, indeed, almost his entire life was spent in Lombardy, mostly between Pavia in the south, and the Lago Maggiore in the north, a range of a mere 120 kilometres. He continued to be a member of the University of Pavia, from his undergraduate studies until the time of his early death, when he was approaching the age of sixty-five in 1905. In comparison with his contemporary or even slightly older colleagues, this extreme local stability appears quite extraordinary, while otherwise, his academic career did not quite exceed the boundaries of average, including a number of senior functions (dean of faculty for three triennial terms, membership in the national Public Education Council).

The year 1878 represented a climax of Maggi's early career. The *Società italiana di scienze naturali* put him in charge of organising their annual meeting in Varese, bringing the elite of Italy's naturalists into the area he was most familiar with. Thus, his colleagues from south of the river Ticino came to visit the numerous places of geological and palaeoethnological interest around the lakes and in the adjacent valleys, with their prehistoric lake and cave dwellings, human remains and artefacts, some of which he himself presented in several papers given at the meeting and published in the *Atti* of the Society (M77-81). This highly successful congress also marked a turning point in Maggi's research directions: For one, he almost completely abandoned geology and palaeoethnology (with a minor exception in 1900, see M261[bis]).[68] Secondly, his approach to the study of microorganisms changed drastically, moving away from questions of the origin of life (heterogenesis) towards a new concept of cell formation out of independently living subcellular organisms, which he called "plastidules" (*i plastiduli*, Fig. 2), a term unfortunately almost identical to Ernst Haeckel's plastidules (which Maggi

67 On the development of earth sciences in Pavia under Taramelli, see Braga (1995).

68 Nevertheless, at the time of his death, the *Palaeoethnological Bulletin* of Rome's *Museo Pigorini* remembered Maggi's relevant publications of the 1870s (Anon. 1905).

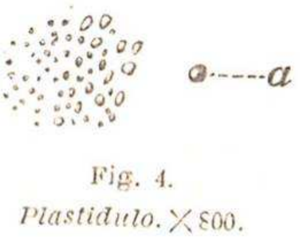


Fig. 2 Plastidules (M121 p. 45)

translated in the feminine form *le plastidule*).[69] What did continue, however, was Maggi's interest in the distribution of protists in the lakes of Lombardy and nearby regions. At the same time, he developed a continuous commitment to issues of hygiene and medicine in general. Initially, his students Giambattista Grassi (1854-1925) and Corrado Parona (1848-1922) had become interested in the hookworm *Anchylostoma duodenale*, suspected to be responsible for a serious condition affecting many of miners working on the construction of the Gotthard tunnel, vaguely described as "pernicious anaemia", and over several years studied the lifecycle and the pathology of this helminth.[70] But single-cell organisms, protists, too, were identified as causes of human disease. Hence, the microscopic analysis of freshwater sources for use as drinking water in the growing cities of northern Italy became another concern where Maggi offered his expertise as the country's leading expert.

Finally, Maggi's academic status was consolidated by his election as ordinary member of the *Istituto Lombardo* in 1879, the Milan academy to which he had contributed as a corresponding member for ten years. Once in place institutionally, Maggi proceeded to establish a regular outlet for reports on his own and his students' research: Previously, he had simply produced small annual booklets entitled "Announcements of studies made in the laboratory of comparative anatomy and physiology".[71] Still in 1879, he joined forces with his colleagues from the medical faculty, Giovanni Zoja and Achille De Giovanni, editing a "Scientific Bulletin" (*Bollettino scientifico*), which covered local research, often in summary form, alongside institutional news and literature reviews, while the most important organ for the publication of extended research papers remained the "Proceedings" (and sometimes the "Memoirs") of the *Istituto*

[69] Haeckel (1876). The latter were thought to be more of the dimension of chemical molecules, carriers of periodic motion, which during procreation they would pass on to the offspring. Against this view, Louis Elsberg (1836-1885) had argued that "the hereditary transmission of these force-waves involves material transmission" (Elsberg 1877:81). Maggi's plastidules, by contrast, were bits of freely living protoplasson, characterised chemically, capable of "voluntary" motion, which he did not think of as "encoding" any kind of inheritable traits. The Haeckel-Elsberg concept of plastidules was criticised by de Vries (1889): 41-47. Hugo de Vries (1848-1935) was primarily interested in identifying the material vectors (*stoffliche Träger*) of inheritance. He did not make references to the Pavia group's efforts.

[70] Belloni (1972), id. (1978).

[71] The second volume included the period prior to the separation of zoology from comparative anatomy (and the addition of comparative physiology to the latter), hence the somewhat cumbersome title of M65.

Lombardo. This pattern, too, remained constant in Maggi's work. At the same time, he quite regularly contributed more general, programmatic articles and outlines of his academic lecture courses to other periodicals, especially the Medical Gazette of Lombardy (*Gazzetta medica italiana - Lombardia*), and a couple of times he wrote philosophical articles for the leading journal of Italian Monism, the "Revue of Scientific Philosophy" (*Rivista di filosofia scientifica*), edited by the renowned psychiatrist from Genoa, Enrico Morselli.[72] In Maggi's earlier days, during his involvement with Varese's *Museo patrio*, he even published short original research notes in the local weekly newspaper, the *Cronaca varesina*, which he would then have re-edited as booklets, with additional lithographic plates, published by the *Museo*.[73] With his growing responsibilities in Pavia, however, the Varese branch of his activity withered, though he bought a house on the shores of the Lago Maggiore, in Germignaga, close to his family home in Rancio. It seems that he and his family spent a significant amount of time by the lake, where Leopoldo went not only for relaxation, but also for working on his numerous publications (Pavesi 1905).

Thus, we can picture Maggi's routine, for the best part of twenty-eight years, working in his laboratory, expanding the museum collections in comparative anatomy and physiology, and teaching students in Pavia, travelling to Milan for the almost monthly meetings of the *Istituto Lombardo*, where he presented his own and sometimes his students' research, which would duly be published in the Institute's organs and summarised in Pavia's *Bollettino scientifico*. When time permitted, he would live in his house on the Lago Maggiore, still immersed in scientific endeavours. And yet, his academic life in Pavia was not free from conflict. Both the growing number of museum specimens and the laboratory for his own and his student's experiments required more space than the university was prepared to offer. From at least the year 1879, Maggi took up a fight for new, larger spaces to house his institute (M95), a struggle which occupied him literally for the rest of his life: He succeeded in the end, and in 1905, days before his death, he was able to inaugurate the new lecture hall in Palazzo Botta, where the institute has since operated for a century,[74] under the same name given by Maggi in 1876, *Istituto di anatomia e fisiologia comparate* (a specific combination which, to the best of this author's knowledge, has only been used in Naples and Genoa, other than in Pavia).[75]

Maggi's main concern throughout the 1880s was the systematic consolidation and popularisation of protistology, including its medical applications, in particular

72 Morselli was also a close follower of Haeckel's work (Di Bartolo 2005a), which led Daniel Gasman to portray Morselli as the direct link between Haeckel's ideology and Italian Fascism (Gasman 1998), a claim which seems at best doubtful.

73 E.g., M40, M49.

74 In 2006, a new life sciences building was completed outside town, under the name of *Botta 2*, hence still echoing Maggi's logistics achievement.

75 Maggi explained his concept in M97, 1880.



Fig. 3 (M121)

the microscopic examination of drinking water supplies. Beginning in 1878, each year he offered an elective course in "Medical protistology" to students in natural history as well as medical students. He also thought of translating Ernst Haeckel's *Das Protistenreich* (1878) for the popular series of scientific manuals by the Milan-based publisher Hoepli; however, Maggi felt that "certain parts of the illustrious professor's discourse assumed a certain scientific knowledge probably not familiar to [the Italian] people", as he wrote in the preface to the volume he had decided to produce instead (Fig. 3): "I therefore thought that what was more necessary for us was a primer for the study of protists".[76] One of the outcomes of Maggi's protistological studies was the concept of what he called "bacterio-therapy" (*batterioterapia*), employing microorganisms – of a kind not harmful to the host organism – to wedge out pathogenic bacteria, an idea based on the Darwinian "struggle for life", over which he got into a priority dispute with the clinician Arnaldo Cantani, at the time based in Naples.[77]

In the same year when his manual *Protistologia* appeared, Maggi also published an article examining "Haeckel's ideas about the morphology of the soul" (M119), his first article for Morselli's *Rivista di filosofia scientifica*.[78] It has to be said that Maggi, at least in writing, tended to be very cautious regarding philosophical speculation and generalisation. Thus, his rare contributions to the *Rivista* and a few other occasional publications offer a welcome insight into his personal

76 "Io l'avrei tradotta in lingua italiana, se certe parti del discorso dell'illustre Professore di Jena non facessero supporre delle cognizioni scientifiche, che, probabilmente, al nostro popolo non sono familiari […] Pensai quindi essere più necessario per noi, una preparazione allo studio dei Protisti;" (M121), preface, unnumbered pages. Maggi did, however, include a significant portion of Haeckel's *Protistenreich*, from the general section, pp. 8-15, translated with minor modifications and additions, on pp. 29-40 of the *Manuale*.

77 M153, M157; see Bazzi & Manara (1980). The idea of a "Darwinian medicine" keeps cropping up at various times in different places, see e.g. Zampieri (2006).

78 On this journal, rallying-point for Italian positivists in the late nineteenth century, see Costenaro (1972), id. (1975). Maggi contributed two more articles for the *Rivista*, one on 'experimental bacteriology' in 1888 (M181), and the other on 'Man's third eye', the role of the pineal gland (epiphysis), in 1890 (M193).

convictions, which also transpire from his not very abundant correspondence with Ernst Haeckel, whom he did not feel confident to contact until he had convinced the *Istituto Lombardo* to nominate the zoologist from Jena as a corresponding member in 1884; and despite Haeckel's regular visits to Italy, it was not until 1903 that the two colleagues finally met face-to-face.[79] We do learn, however, from the testimony of Maggi's colleagues, especially in the obituaries, that in speaking and lecturing, the Lombard anatomist was not hiding his adoration of Haeckel's œuvre. Also, in contrast to the rigid positivist presentation of Maggi's own research, some of his students produced more speculative, almost deductive work: a notable example is Giacomo Cattaneo's geometrical classification of organisms, based on Haeckel's *Grundformenlehre* already developed in 1866.[80]

In 1888, Maggi was elected for a three-year term as Dean of the Faculty of Mathematical, Physical, and Natural Sciences. It might be misleading, however, to attribute the sharp drop in the number of his publications in 1890 entirely to his occupation with administrative duties, as this year also marks another radical reorientation of his research, which had begun well before his tenure as Dean (M180): From the infinitely small, Maggi directed his gaze towards the biggest animals on earth, namely, vertebrates, and in particular, the formation of their skulls. On the one hand, this interest reflected the development of the museum of comparative anatomy and physiology, which Maggi still directed, but at the same time, as will be discussed in chapter 7, there is a potential logic in this course, which was at least sufficient for a retrospective rationalisation. The *leitmotif* in Maggi's comparative anatomy can be described as a principle of unity, unity of the world (living and not, in heterogenesis), unity of the living (protists, plants, animals), unity across the animal kingdom, in particular vertebrates, from cartilaginous fish to primates, from sturgeon to the human race. The singular form of the last word is very important: Maggi, like the majority of Italian anthropologists, was interested in unity not difference. Anthropology in Italy had been launched under the auspices of national unification, true to Massimo d'Azeglio's maxim to "create the Italians". Military service was used as a central tool for the homogenisation of Italy's young male population, and physical examination of conscripts was one of the first fields for anthropological research. Emphasising the considerable variety of human phenotypes across the peninsula was not a desired outcome during the initial phase of Italian anthropology aimed at forging Italians, even though, as we will discuss in more detail, later there was a development aimed against German claims of racial supremacy (Orsucci 1998),

[79] Their correspondence has been transcribed and translated in the appendix of this thesis; only Maggi's letters seem to have survived. Extensive searches for his papers in Pavia and the Valcuvia have revealed little, and Haeckel did not keep copies of the innumerable letters he wrote; see Hoßfeld & Breidbach (2005), iid. (2006).

[80] See esp. Cattaneo (1883a) and the review by Pilo (1886). Haeckel had introduced his concept of fundamental organic forms in the first volume of his *Generelle Morphologie* (1866), fourth book: *Generelle Promorphologie*, pp. 375-574 and plates I+II.

which led one of the quite distinctive "schools" of anthropology, the one launched by the Roman philosopher Giuseppe Sergi, to venture into racial anthropology.[81] This sentiment was not shared by the doyen of Italian anthropology, Paolo Mantegazza, who had founded the first institute in Florence, and it was most definitely not relevant for the Germanophile Leopoldo Maggi, who, on the other hand, seemed to have been held in little esteem by his former senior colleague Mantegazza.

Thus, for the last fifteen years of his life, Maggi focused on his craniological studies, though during his second term as Dean of the faculty (1891-1894), he kept up with developments in protistology, updated his Hoepli guide (^{2}1893) and wrote another volume for the same series, *Tecnica protistologica* (1895), a laboratory manual, which was to be his last work in the field of protistology. In the light of his problematic relationship with Italy's anthropologists, it is striking to see that Maggi himself would not class his craniological work as anthropology, at least not in retrospect: In the last published version of his bibliography (M272), he did not even mention that he had published his first major paper on craniology in Mantegazza's *Archivio*, at the same time as in the *Rendiconti* of the *Istituto Lombardo* (M194).[82] It is thus not the case that Maggi had not sought the anthropologists' attention, but it seems that the overly frosty reception of his work, referred to as mere "bone counting", deterred him from pursuing this discipline any further, although he did get some following among younger anthropologists. But when one of his disciples, Fabio Frassetto (1876-1953), by then an established anthropologist, defined a "Maggi school" of anthropology (Frassetto 1905a), Mantegazza's reaction was outright hostile, as we will see in more detail in chapter 7 (M[antegazza] 1905).

After his second term as Dean, Maggi launched himself more deeply into the last administrative struggle of his life, defending laboratory and museum space against the takeover by his internationally celebrated colleague, the histologist Camillo Golgi. As we have heard, eventually Maggi's campaign was crowned by success, but he did not live to reap the benefits, which were left to his successors. Undeterred, for several years he went on "counting bones", as Mantegazza went on reporting ironically in his *Archivio*. In 1899, Maggi was elected for a third triennial term as Dean of the faculty. In the same year, his trusted colleague and co-editor of the *Bollettino scientifico*, Giovanni Zoja, died, and the *Bulletin* was discontinued. In 1900, Maggi assumed more administrative duties, even at national

81 Sergi (1900). His ideas were made popular in North America through Paul Carus' journal *The Monist* (Sergi 1898, id. 1902, etc.).

82 The German anatomist Ferdinand Graf von Spee (1855-1937) did notice: Maggi's paper on the cranio-pharyngeal canal is the only one cited in the handbook section on the cranial skeleton, both the version in the *Rendiconti* and the, identical, publication in the *Archivio* (Spee 1896:147).

level, as appointments commissioner (*commissario di concorsi*) and member of the High Council of Education (*Consiglio superiore della Pubblica Istruzione*).[83]

After the turn of the century, Maggi started bringing together his single observations (M261), and in 1903, he used his obituary of Carl Gegenbaur and a review of Carl Vogt and Emil Yung's textbook on Comparative Anatomy to formulate some more general concepts for their discipline, in view of the threat that its teaching as an autonomous area was to be abolished, according to a decree from the Minister of Education, Nunzio Nasi (M278, M279). Towards the end of 1903, he finally met his venerated master, Ernst Haeckel, who was spending the winter in Rapallo (near Genoa), working on *The Wonders of Life*,[84] sequel to his most successful popular philosophical book, *The Riddle of the Universe* (1899).[85] In the following autumn, Ernst Haeckel came back to Italy for the "International Congress of Free Thought" in Rome (Sept. 1904), but Maggi was unable to attend since he was not feeling well.[86] He was still able to inaugurate the lecture theatre in the new location of his institute, in the Palazzo Botta, giving a talk on "Co-ordinating and Comparing", his last publication, which survives as a lithographed brochure (M283): On the 7th of March, 1905, he died,

> *while preparing a memoir for the Istituto Lombardo,[87] with the usual cigar in his mouth, pen in hand, taking notes from a German volume,[88] right at the time when he was preparing himself to bring together the numerous and extensive studies in craniogeny which, for fifteen years, he had been pursuing with fortunate success.[89]*

Two days later, he was buried in a civil ceremony, led by Camillo Golgi, at the time rector of the university. The zoologist Pietro Pavesi read a eulogy for his deceased colleague. The local newspaper carried a long and detailed report, emphasising Maggi's role as a teacher for the new generation of naturalists.[90] Over the next months, commemorations were held and obituaries published by some of his students and colleagues, notably Fabio Frassetto for the Anthropological

83 Ciampi & Santangeli (1994): 287, 321.

84 *Die Lebenswunder*, to be published in German in 1904, Italian translation by Daniele Rosa (1906): *Le meraviglie della vita*. Turin: UTET. On Rosa, a remarkable evolutionary theorist at the turn of the century, see La Vergata (2001).

85 Translated into Italian by Amedeo Herlitzka (1872-1949) and published by UTET in Turin in1904 (see Morselli 1904). On Herlitzka, an important physiologist who in 1938 was dismissed from his university post in Turin due to Fascist anti-Jewish legislation, see Rowinski (1950), Troiani & Manni (2007): 126.

86 Letter Maggi to Haeckel, 27 Nov. 1904, EHH. The transactions of that congress have been published: Associazione internazionale del libero pensiero (n.d. [ca. 1905]).

87 "mentre preparava una memoria per l'Istituto lombardo" (Cattaneo 1905:78).

88 "con l'abituale sigaro in bocca, la penna in mano, prendeva appunti da un volume tedesco" (Pavesi 1905:8).

89 "proprio quando già si disponeva a raccogliere le numerose ed estese ricerche di craniogenia che da quindici anni andava facendo con fortunato successo" (Frassetto 1905:321).

90 *Provincia Pavese*, 10/11 March, 1905: 'I funerali del Prof. Leopoldo Maggi'.

Society of Rome, and Giacomo Cattaneo for the *Monitore Zoologico Italiano*, the leading review journal in zoology. Paolo Mantegazza, under his usual initial "M.", wrote a note in the Florentine *Archivio dell'Antropologia*, extremely brief yet inaccurate: "During the last months, anthropology has lost a distinguished [sic!] cultivator [*cultore*], in the person of Prof. Leopoldo Maggi of the University of Pavia. Although he was teaching zoology [sic!][91] and was not a member of our society, it is nevertheless our duty to remember his work in our field." (M[antegazza] 1905a). We will return to Mantegazza's acknowledgement of Maggi's achievements in chapter 7.

Eight years later, in May 1913, two plaques were unveiled in the courtyard of the university's main building, one in honour of Maggi, the other dedicated to Pietro Pavesi, who had died in 1907. At the ceremony, two of Maggi's former students spoke about their maestro, first Andrea Giardina, who had succeeded Maggi as director of the Institute for Comparative anatomy and physiology, then Edoardo Bonardi, chief physician (*medico primario*) of the *Ospedale Maggiore* in Milan, who had been Maggi's assistant from 1883 to 1890. Giardina remembered Maggi's plastidular theory as a "precursor" to Merezhkovski's work[92] and again his role in creating a research "school", while Bonardi emphasised the complementarity of Pavesi and Maggi, and the sincerity and social commitment of both researchers.[93]

On the centenary of Maggi's birth, the leading British scientific journal *Nature* carried a brief note in the 'News and Views' section, remembering the career of the "eminent Italian protozoologist and craniologist", citing a somewhat random collection of his popular and medical works[94] as his "chief publications" (Anon. 1940) – incidentally, just one month before Mussolini declared war on Britain and France in June of the same year. After the war, we find no further references to Maggi until the publication of Patrick Tort's three-volume *Dictionnaire du Darwinisme et de l'évolution* in 1996, where contributor Giovanni Landucci offers a brief biographical entry, together with some sixty other Italian participants in the debate of Darwinism, and a few remarks in the extensive entry on 'Italian Darwinism'.[95] In recent years, attention to the history of Darwinism in Italy has grown considerably,[96] and in 2002, the municipality of Cuveglio, a hamlet in the Valcuvia, organised a symposium dedicated to Maggi, who had spent so much of

91 As we have seen, the only time Maggi ever taught zoology was the second half of 1875 (M65); since then, Pavesi held the chair of zoology, while Maggi headed Comparative Anatomy and Physiology.

92 See Höxtermann (1998).

93 Reported in the newspaper *Provincia Pavese*, 26/27 May 1913.

94 M139, M145, M160, M172, and one unidentified title, 'I microbi vantaggiosi all'uomo' (1888) [could that be *piccoli benefattori*?]; no reference to either the successful Hoepli manuals or any of his numerous craniological papers.

95 Landucci (1996a), id. (1996).

96 A highly relevant contribution was the conference dedicated to Giovanni Canestrini in 2000 (Minelli & Casellato, eds., 2001), and the bibliography compiled by Coccia (2003).

his scholarly and private life in this, his area of origin (Fig. 4). Finally, on the one-hundredth anniversary of his death, in 2005 the University of Pavia arranged an exhibition of Maggi's didactic wall charts.[97] Eventually, the *Italian National Biography* reached the position MAG in the alphabet in 2006, containing a two-page entry on Leopoldo Maggi in volume 67 (Barbagli 2006).

Thus, in the end, Maggi's life has been rescued from obscurity, some of his many works and few letters summarily re-examined. The following, more detailed studies of central aspects of his activities are an attempt to demonstrate the added value that historiography can derive from the biography of a scientist, who for half a century has been closely involved in the development of life science in all its aspects, practical, theoretical, institutional, educational, and, inevitably, ideological as well, without giving in to lurking temptations of glorification or apologetics, of which much of the scholarship surrounding Ernst Haeckel and his followers stands accused (Gasman ^{2}2004:xi-xxxi).



Fig. 4: Commemorative volume Valcuvia 2002

[97] The symposium resulted in the publication of a special issue of the local journal *Terra e gente* (Armocida et al., eds., 2002), and with the exhibition, a lavishly illustrated catalogue was produced (Rovati & Violani, eds., 2005).

The origin of Italy, geology, and patriotic museums

The unification of the Italian peninsula between 1861 and 1870 under the lead of intellectuals, academics, and scientists created a marked desire to study and appropriate the territory, both its physical and its historical aspects. In addition, practical considerations of a largely agricultural country, at the brink of industrialisation, contributed to the exploration of natural resources, including mineral deposits, drinking water supplies for the growing cities, and sanitary improvements for humans, domestic animals, and farm crops. Universities were among the main beneficiaries of and contributors to these developments, as will be confirmed in different fields which Maggi cultivated during his career, medical protistology in particular. But his first full academic position obtained after graduation in 1863 was in geology and mineralogy, a field he had studied with the internationally renowned abbot Antonio Stoppani (1824-1891),[98] who had been teaching at Pavia during the academic year 1861/62, as well as with his mentor Giuseppe Balsamo Crivelli. As Vaccari (2002:36 and fn. 4) has pointed out, the first decade of the Italian unification saw a significant increase in the teaching of geology and mineralogy at universities across the peninsula. It needs to be remembered, though, that naturalists had been protagonists of the *Risorgimento* for years, prior to its provisional conclusion after 1859, and not only in the political

[98] On Stoppani, see Daccò 1991.

arena, but through their scientific endeavours as well. In Milan, a "Geological Society" was formed in 1856/57, but only after the cession of Lombardy to the nascent Italian kingdom was the organisation able to change its name to *Società Italiana di Scienze Naturali*, which continues to be one of the most important scientific societies in Italy,[99] while at the time, it was to play an important role for the launch of Maggi's academic progress.

Throughout his academic career, Maggi took great care documenting his teaching, usually publishing a programmatic introduction and/or a list of themes covered during the year. Thus, when Maggi took up his lectureship in the autumn of 1863, he had the introduction to the first course he taught in his new position printed (M3). Alas, even at the time when Maggi had his offprint collection bound, the printed version was no longer available.[100] Therefore, in comparison with his later courses in life sciences, we know little about Maggi's teaching in geology, except for a few short notes on geological excursion with his students, sometimes in his own name, occasionally under the name of his students, which even made it into the local paper of Varese, the *Cronaca Varesina*.[101] We do have, however, a number of significant research publications providing insight into the naturalist's interests, even while, at the same time, he continued to pursue his biological interest and became involved in some palaeoethnological research.

Already in his first geological publication in 1866, Maggi stated that

> *for several years, I have had the intention to undertake studies into the natural history of the Valcuvia [Cuvia Valley], which, as is known, is situated in the middle of the territory Brunner used to call the geologist's paradise. (M5:35)*[102]

In fact, by the time of writing these lines, Maggi had been teaching mineralogy and geology for three years. Previously, as a student, he had already collected some experience in these domains while working in the geo-mineralogical section of Pavia's Museum of Natural History.[103] At the young age of twenty-three, he therefore had some points in his favour to justify the appointment. He engaged right away in one of the major debates in mid-nineteenth-century geology: the

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99 See their website at http://www.scienzenaturali.org/index.jsp.

100 Neither the present author nor Vaccari (2002:38 and fn. 11) have been able to locate this fascicle.

101 E.g., in July 1875, a report by Maggi's student G. Malacrida: 'Intorno ad una gita geologica nel territorio di Varese, fatta da una comitiva di studenti di storia naturale all'Università di Pavia', *Cronaca Varesina* 13, also published separately in Pavia: Bizzoni.

102 "Le pays situé entre les trois lacs est digne du nom de paradis des naturalistes […] par les phénomènes géologiques remarquables qu'il enferme" Brunner (1852:3). The Cuvia valley is located close to Lake Lugano, though it drains into the Lago Maggiore. Brunner [later von Wattenwyl, 1823-1914] was a well-known Swiss geologist and entomologist, later working in Vienna, where he died at the beginning of World War I; see Gerber (2005).

103 A collection which went back to the efforts of Lazzaro Spallanzani, who had laid the foundations of the museum in 1771, with active support from Empress Mary Therese (Rovati & Galeotti eds., 1999).

existence of a geological epoch characterised by widespread glaciation, an Ice Age. A number of independent observations in different countries during the 1820s and 30s had indicated that glaciers must have been much more extensive during the geological past. Eventually, the Swiss geologist Johann (Jean) von Charpentier (1786-1855), a student of Abraham Gottlob Werner (1749-1817) in Freiberg, Saxony, formulated a comprehensive glaciation theory in his *Essai sur les glaciers et sur le terrain erratique du Bassin du Rhône* (1841). The opposing camp, going back to the works of another student of Werner's, the German geologist Leopold von Buch (1774-1853), held the view that the "erratic" deposits were the result of catastrophic inundations,[104] following Werner's "neptunist" views on the exclusive role of water in the creation of rocks – hence, we are witnessing an inter-neptunist dissent, rather than a clash with the rival camp of Huttonian "plutonists". In several Alpine valleys, far below the contemporary range of glaciers, massive "erratic" sediments showed clear signs of having been moved not by currents of water, but by enormous solid flows of ice. These sediments proved particularly conspicuous in the Valcuvia, where Maggi had decided to take up his geological field research. During the first three years of painstaking classification and reconstruction of Valcuvia's glacial past, Maggi went to apply strictly actualist principles to the comparison of contemporary glacier lakes and the vestiges of ancient ice flow: "to identical effects, there are corresponding identical causes",[105] he professed in his most important geological work (M15), published in the proceedings of the *Istituto Lombardo* in 1869. In this article, Maggi demonstrated the connections between glacial sediments in the valleys east of the Lago Maggiore, which today are tributaries to the lake, whereas the deposits clearly indicated that the glacier had once invaded those valleys from the Lago Maggiore area (ibid.).[106] Significantly, he made it clear that traces of the effects of "liquid water" could well be accounted for in the context of glaciation, as the movement of glaciers led to the formation of lakes and streams, both at the margins and at the bottom of the ice shield; hence the term *depositi lacustro-glaciali* (glacial lake deposits) for the layers formed in those glacier lakes. At the same time, he also used his regular excursions into the Valcuvia for collecting specimens of infusorians, which he described in an extensive paper published in the *Atti* of the *Società italiana di storia naturale* in 1876, after his appointment to the chair of Comparative anatomy and physiology (M62), followed by a similar work on the infusorians of the regional capital Milan (M63).

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104 Greene (1982:73). Greene pays remarkably little attention to glaciation, considering that he is discussing *Geology in the Nineteenth Century*; Charpentier is not even mentioned once. On the formation of Werner's Neptunist stratigraphy in the context of German Romanticism, see Rupke (1983):404-406.

105 "*ad identici effetti corrispondono identiche cause*" (M15:4).

106 Violani (2002): 53f. For a general description of the area's topography and natural history, see Maggi's opening speech at the seventh extraordinary meeting of the *Società italiana di scienze naturali* in Varese in 1878 (M78).

Those where also the years when the first prehistoric lake dwellings were excavated in Italy. The first description of those *Pfahlbauten* in Switzerland dated back to 1854, after a particularly dry season had uncovered lake floors and river beds in the Swiss Alps. Within a decade, hundreds of lake dwellings were located across the country, containing significant quantities of artefacts and human remains. From the mid-1860s, palaeontologists and other scientists made their mark on a field previously dominated by archaeologists and historians. Rudolf Virchow (1821-1902) pronounced himself on *Pfahlbauten*, as did Hermann Schaaffhausen (1816-1893).[107] During the 1860s, similar prehistoric settlements were discovered in Lombardy and other regions south of the Alps. In Italian, those structures found in the mountains were named *palafitte*, whereas in the plains of northern Italy, they were known as *terramare*.[108] Initially, though Italian naturalists like Emilio Cornalia of the Milan Natural History Museum were involved in these surveys, there was a perceived dominance of Swiss and German scholars, at a time when the political relationship between the Kingdom of Italy and the Habsburgs was still tense. Only in 1866 had the Veneto been joined to the Italian state, and South Tyrol remained "unredeemed" (*irredenta*) until the collapse of the Austro-Hungarian Empire at the end of World War I. It was in this atmosphere of *Irredentismo* that count Carlo Belgiojoso (1821-1881), erstwhile activist of the early nationalist movement in the 1840s, lamented the inadequacy of the Italian government's efforts for the safekeeping of the "fatherland's monuments" (*monumenti patrj*), proposing centralised measures to reduce the loss of Italy's heritage.[109] In the town of Varese, near the homonymous lake where the first "Italian" *palafitte* had been excavated since 1863, local individuals thus established a Fatherland Museum (*Museo patrio*), in order to keep control over the area's natural and cultural conditions. The museum was founded in 1871, on the occasion of the first regional exhibition of agricultural and artisanal products in Varese, organised by the Lombard Agricultural Society, which included a section on archaeology. At that time, the Prussian historian Theodor Mommsen travelled the region collecting historical inscriptions; this was a precarious moment, during the Franco-Prussian war of 1870/71, which politically affected the Kingdom of Italy intimately: It needs to be remembered that Rome and Papal Latium were still protected by a French garrison, while the activists of the *Risorgimento* were uncompromising in claiming Rome as the capital of Italy. Although the Prussian victory over the French army at Sedan (1 September, 1870) allowed Italy to capture Rome three weeks later, Italian attitudes towards Germany remained ambivalent. Thus, Andrea Apostolo, one of the founders of the *Museo patrio*,

107 For a concise overview of *Pfahlbauten* anthropology, see Weiler (2006): 95-98. From a prehistoric perspective, see Schlichtherle (1997).

108 De Marinis (1983); Bernabò Brea (1997). The distinction between palafitta and terramara is not always strictly observed.

109 Belgiojoso (1868). On the author, see the obituary by Sangiorgio (1881).

complained about Mommsen's presence in a wakeup call for the creation of the museum, warning that those transalpine investigations would lead to a 'cultural appropriation at the expense of the Italian heritage, deliberately attempted by the "*Alemanni*" in order to legitimate a German superiority over the Latin peoples'.[110]

Finally, the museum society was launched on 16 October, 1871, with Maggi being elected to the council of the natural history section.[111] When the first exhibitions were organised in the town hall later in the same year, Maggi contributed his very conspicuous collection of rocks, which he had collected during his survey of the Valcuvia: as many as 462 specimens, according to the records.[112] Despite his time-consuming commitments in Pavia, Maggi continued his support for the museum in Varese over the coming years. Several of his letters to the museum's board of directors have been preserved in the town's archive, providing further evidence of the naturalist's ongoing involvement, especially during the early years of the museum's existence. His interventions give testimony of his own approach to natural history and evolution, as he insisted, against some resistance from his colleagues, on a chronological display of the specimens, and he gave advice on systematics and taxonomy.[113]

The national interest in the Varese lake dwellings was emphasised by the Italian Society for Natural Sciences, whose decision to hold a meeting in Varese in September 1878 was explicitly motivated by the most recent discoveries of a well-preserved *palafitta* on the islet of Lake Varese by the British archaeologist W. K. Foster in April and May of that year.[114] This meeting, as we have heard, was chaired by Leopoldo Maggi, who organised excursions to the main prehistoric sites of the area, including the little island, which on the occasion was named *Isolino Virginia*, to honour the island's owner's wife, Virginia Ponti Pigna, as Maggi

110 On the *Esposizione Agricola-Industriale dell'anno* 1871, organised during the congress of the *Società Agricola di Lombardia*, see Basso (1990):8-10. She paraphrases Apostolo's concerns: 'l'appropriazione culturale a danno del patrimonio italiano tentata volutamente dagli "Alemanni" al fine di legittimare una superiorità tedesca rispetto a quella latina', from the manuscript of Apostolo's address at the congress, under the title of "Thirty Roman inscriptions" (*Trenta iscrizioni romane*).

111 The list of officers has been reproduced in Basso (1990:22): *Elenco degli Uffici della Società del Museo Patrio*. Contini (2002:27, fn. 23) claims that Maggi had initially been voted President of that section, but that claim is not borne out by the official document.

112 When the present author visited the *Museo patrio* for the first time in 1994, this collection was no longer identifiable. We get an impression of Maggi's comprehensive geological and mineralogical knowledge from his "Catalogue of the rocks of the Valcuvia", presented at the 1878 congress of the *Società italiana*, where the author also describes his donation to the museum (M79:862).

113 *Archivio Storico del Comune di Varese, Fondo Museo Patrio*, paraphrased in Basso (1990:23).

114 De Marinis (1983): 74f. [though he writes "Forster"]; on these excavations, see Munro (1890), Evans (1985) mentions a W.K. Foster bequest at the Museum of Ethnography and Archaeology, University of Cambridge. According to personal information from Anne Taylor, Museum of Archaeology and Anthropology, University of Cambridge, Walter K. Foster died on 5 July 1891 and was commemorated in the museum's annual report in 1892.

reminded his readers many years later (M271).[115] The Ponti family continued to sponsor the excavations well into the twentieth century, when a catalogue of the objects retrieved from the lake dwellings on the *isolino* was published in 1913.[116] However, Maggi himself was no longer involved in this line of research after the meeting in 1878, through which he had succeeded in making himself a name as a widely knowledgeable naturalist, both nationally through the *Società*, and locally among the supporters of the *Museo patrio* and the readers of the weekly *Cronaca Varesina*, contributing to the "re-appropriation" of the Fatherland's natural and cultural heritage.

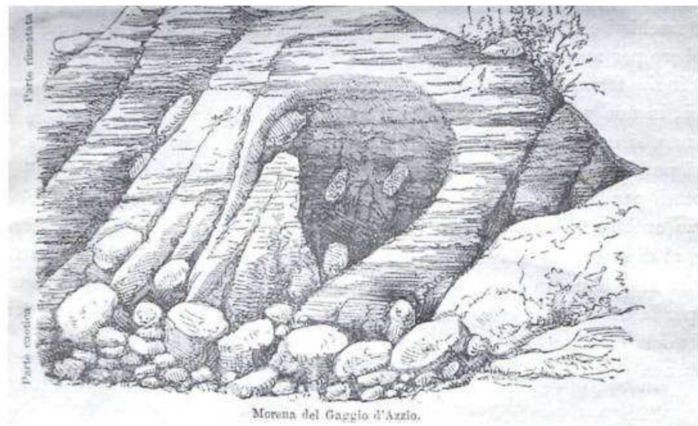


Fig. 5: Sandy deposits of the moraine of Gaggio d'Azzio (Valcuvia)
M15 (Memorie) p. 25.

115 The visit was captured in a lithograph by A. Ogheri given to the participants of the Society meeting. A reproduction can be found in Banchieri (1992:11).

116 De Marinis (1983):78.

The origin of life

"Experiments performed in sealed vessels will never convince the miscreants, because there will always be experiments where infusorians or moulds will be found, and others where no living being is to be seen, and some will say that where they appear, some inadvertency has introduced germs, while others will scream at the top of their voices, saying that the field of live has been tortured to a degree that it has become sterile".[117]

[117] "Gli esperimenti fatti in vasi chiusi non persuaderanno mai i miscredenti, perché vi saranno sempre esperienze nelle |9| quali si avranno infusorj e muffe, ed altre nelle quali non si vedrà alcun essere vivo, e gli uni diranno che dove compajono si è perché qualche inavvertenza ha introdotto i germi, e gli altri grideranno a piena gola che si è tanto tormentato il campo della vita, per cui si è reso sterile." (Mantegazza 1864a:8f.)

In 1864, the debate about the origin of life was in full swing in various parts of Europe.[118] In Italy, a controversy had been simmering since the times of Francesco Redi (1626-1698) and Lazzaro Spallanzani (1729-1799). At the time of the French Revolution and its aftermath, the question became highly politically charged, spontaneous generation being associated with Jacobin materialism and even atheism. Thus, during the revolutionary first decade of the nineteenth century, the physician-writer Giovanni Rasori (1766-1837) was able to publish an Italian translation of Erasmus Darwin's *Zoonomia* (Milan 1803-5) and discussed the Englishman's theory of spontaneous generation positively. With the political restoration of Habsburg control over Lombardy, Rasori was incarcerated for his role in a suspected military conspiracy and never to return on any teaching position. Although his translation of E. Darwin's work remained in print even after being banned under Pope Pius VII in 1817,[119] the author's presumed materialism was repeatedly criticised in Italian reviews, and French ideas of transmutation fared no better: the period of post-Napoleonic restoration benefited the "conservative" Cuvierian camp at the expense of the Lamarckists. Italian students of Lamarck's, among whom there was a fair number of subsequently influential individuals, had to operate "underground", with limited abilities to go to press, past generally rigid censorship.[120] In the late 1820s, the influential spiritualist philosopher Antonio Rosmini (1797-1855) rejected Lamarck's ideas of spontaneous generation and opposed the 'reduction of vital phenomena to physico-chemical phenomena' (Landucci 1996:959-61). Rosminian ideas held a strong influence over philosophical concepts of life in the Italian debate well beyond the author's lifetime. And yet, Lamarckian ideas continued to be discussed in Italy, especially in the more liberal period from the end of the 1830s, which saw the organisation of annual "Congresses of Italian Scientists", aimed at bridging the communication gaps between the numerous States and territories whose borders criss-crossed the peninsula.[121] Together with Lamarck's theories, E. Geoffroy de Saint-Hilaire's philosophy of the "unity of plan", against Cuvier's insistence on the irreducible difference between four "embranchments" of animal organisms (Appel 1987), was gaining influence in the middle decades of the century, notably in Pavia, with the teaching of anatomist Bartolomeo Panizza, naturalist Giuseppe Balsamo Crivelli, and their students, among whom we find

[118] The literature on the so-called "spontaneous generation controversy" is vast. For a broad overview see Farley (1977); from the perspective of a practising biologist: Harris (2002). Some important terminological clarifications are made by McLaughlin (2006).

[119] Gregory XVI (1852): 146. A further edition of Rasori's translation appeared in Naples 1820, a second Milanese edition (1834-36) during the last years of Rasori's life as a practising physician in Milan.

[120] On the role of Lamarckism in early-nineteenth-century Italy, see Camerano (1910), Omodeo (1949), Benasso (1976), Pancaldi (1983), Corsi (1983), Omodeo (2001).

[121] Bartoccini & Verdini (1952); Pancaldi (ed. 1983).

prominent figures such as Cesare Lombroso (1835-1909), Paolo Mantegazza, and Eusebio Oehl (1827-1903).[122]

The ancient problem with its profound philosophical and theological ramifications was reformulated in the wake of the establishment of Schleiden and Schwann's cellular theories and the wider availability of microscopes with increased magnification and improved resolution in the middle of the nineteenth century (Jahn 2003a:14f.). Experiments remained on the whole inconclusive, as Mantegazza's quote shows, despite of Pasteur's rhetorical triumph at the Sorbonne three months after Mantegazza's intervention.[123] What was at stake was the question of special creation versus natural origin of living species, but also, more profoundly, the nature of life itself: was it some property inherent to a certain type of organic matter, which could be destroyed irrevocably by "torturing" the samples beyond restitution, or was it an emergent quality which the right composition of chemical elements would obtain spontaneously? Lamarck had argued, earlier in the century, that all organisms had developed from spontaneously generated simplest forms, through gradual perfection and inheritance of acquired characteristics, in a linear chain of progression, without genealogical relations between individual lines (Lamarck 1809). Hence, the most complex forms now living would have gone back the furthest in time, while simple new organisms continue to arise and inaugurate new lines of progressively more complex species. Darwin, on the other hand, was notoriously reticent about the origin of life,[124] but in contrast to Lamarck, he envisaged a multiplication of species from few original forms, a concept efficiently visualised in Ernst Haeckel's phylogenetic trees (Haeckel 1866), borrowed from August Schleicher's genealogy of Indo-European languages.[125]

Spontaneous generation had been Paolo Mantegazza's concern right at the beginning of his academic career, when he presented a widely received memoir at Milan's *Istituto Lombardo di scienze e lettere* on 5 August 1852, published in the Institute's *Journal* (Mantegazza 1852)[126]. In this paper, Mantegazza reviewed the debate regarding mainly infusorians, from the time of Leeuwenhoek's first pepper infusion in 1676 (only in passing did he mention some references to the presumed

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122 Landucci (1996):974.

123 The experiments presented by Mantegazza in 1864 were inspired by his criticism of Virchow's *Cellular Pathology*, see Dröscher (1998:98).

124 At least in public, see Strick (2000):49. Already in his notebooks dating from the years 1836 to 1844, just after his return from the circumnavigation on board the Beagle, Darwin had admitted that spontaneous generation was "not improbable" (Barrett et al 1987:269), see Richards (2008):137.

125 Schleicher (1863), see Koerner (1987). Indo-European linguistics was slow to take root in Italy. An early example for "evolutionary" linguistics was the – partly unpublished – work by Paolo Marzolo, who was to have an important influence on Cesare Lombroso (Landucci 1996:978f.).

126 On Mantegazza's early career, see Gatti 2001, esp. p. 244 and fn. 1223 for the episode in question.

spontaneous generation of intestinal worms and other complex organisms). But Mantegazza's emphasis was strongly on microscopic work ("micrography"), as he reported some of his own experiments performed with a variety of decoctions, coming to a cautiously positive result for the existence of heterogenesis: the quantity of microbes found after incubation would make it inconceivable to assume that an equivalent number of "germs" had been present in the carefully limited amount of air enclosed with the liquid. As for possible contamination in the process of observation, the generally accepted time it took for active organisms to develop from airborne germs was far longer than the brief moment his procedures took after breaking the seal of the flasks.[127]

Twelve years and several voyages across Europe and Argentina later, Mantegazza had become a prominent "effective member" of the Lombard Institute and a respected professor of pathology at the University of Pavia (Landucci 1996b:2797). But the battle over spontaneous generation had not lost his attention; he and his colleagues, notably Balsamo Crivelli, Panceri, Maggi, and Eusebio Oehl, closely followed and commented on the French Academy debate raging between Pasteur, Pouchet, and Donné. [128] At the regular meeting of the *Istituto Lombardo* on 7 January, 1864, Mantegazza proposed the creation of a commission dedicated to the study of heterogenesis, which is to say the spontaneous generation of microscopic organisms from lifeless, decomposed organic matter, rather than from inorganic substances (which would generally be called "abiogenesis"). The published minutes of the meeting record a detailed response by the physicist Giovanni Cantoni, who reminded the audience of [Marcellin] Berthelot's chemical researches, suggesting that Pasteur's "diligent experiments" had been lacking in providing the necessary "conditions of temperature, humidity, electricity, etc." to allow for the generation of life (in Mantegazza 1864a:14). Finally, his naturalist colleague, Giuseppe Balsamo Crivelli, concurred citing botanical work by [Friedrich Traugott] Kützing (1807-1893), who had found distinctive, newly formed algae in the organic films formed on infusions prepared from animal as well as plant material, and the work Kützing and Hermann Schaaffhausen had done on the metamorphoses of unicellular

127 Although academic naturalists in Northern Italy tended to follow developments beyond the Alps with particular attention, Mantegazza's convictions were not informed by the "autochthonous generation" debate, conducted during this period especially by German scholars such as Haeckel's teacher, Johannes Müller (1801-1858), Hermann Burmeister (1807-1892), and Darwin's translators and collaborators Heinrich Bronn (1800-1862) and Carl Vogt (1817-1895) (Rupke 2006, Amrein & Nickelsen 2008). Mantegazza discussed current microcreation, and after reading *The Origin*, he became one of the most convinced followers of Darwin's theories of descent and selection, alongside Giovanni Canestrini (Pancaldi 1983/1991).

128 On the French debate, see Latour [1984] 2001, Geison 1995, Roll-Hansen 1998, Harris 2002. Though Alfred Donné is hardly mentioned in recent studies of the Pasteur-Pouchet debate, his contributions were extensively commented by members of the Pavia group.

organisms.[129] These presentations made it clear to the members of the *Istituto* that the proposed enterprise covered a topic which was at the forefront of international research interest. In the end, the Institute elected a commission, made up of Mantegazza, Cantoni, Balsamo Crivelli, as well as clinical chemist Giovanni Polli (1812-1880)[130], entomologist Emilio Cornalia (1824-1882), and botanist Santo Garovaglio (1805-1882) (ibid.). Subsequently, Mantegazza did not play a major role in the commission's work, even during the years he still spent in Pavia before moving to Florence.[131] Leopoldo Maggi, recently graduated, immediately became a committed member of the group researching the occurrence of heterogenesis in boiled organic liquids, working with Balsamo Crivelli and Giovanni Cantoni. The commission members continued to follow very closely the results of research going on abroad. In the introduction to the first relevant publication resulting from their joint efforts, (Balsamo Crivelli & Maggi 1867, M6), the authors point out that they are responding to a recent line of argument proposed from Montpellier by Alfred Donné (1801-1878), who had initially rejected spontaneous generation (Donné 1863), but recently, after three years of further experimentation, published a memoir in its favour, which had attracted severe criticism from Pasteur (Donné 1866). Donné's approach dealt with objections which had been raised against the heating of the organic substrate used in conventional generation experiments, by which process the "vital powers" of the matter might be destroyed. Hence, he used organic matter which by nature could be considered pure, as he said: namely, the content of fresh eggs, which were known to be "ready to give life", but protected by the shell (and additionally, by varnish or by an envelope of carded cotton[132]) from possible germs precipitating from the atmosphere. Even in those conditions, moulds (*moisissures*) are forming on the surface of the egg's matter, but no protozoa (*animalcules*), a result which Donné attributed to a lack of water inside the egg. Hence, he pierced the mouldy egg through the cotton cover with a scalpel first brought to red heat and introduced some boiling water, and within a couple of days, the matter would

129 Though better known as an anthropologist, who had described the type specimen of the controversial Neanderthal skull fragment in 1857, Schaaffhausen for years conducted experiments into spontaneous generation (Schaaffhausen 1865), which were promptly (and critically) reviewed in the *British Medical Journal* vol. 2 n. 200 (1864):495 (Strick 2000:50f. and note on p. 222). On Schaaffhausen the anthropologist, see Zängl-Kumpf (1990), with a bibliography including Schaaffhausen's work on spontaneous generation.

130 On Polli, one of Mantegazza's former teachers, see Dall'Olio & Piva (2003).

131 He did however become a convinced supporter of Darwin's pangenesis hypothesis, pointing out "that he, (in his 'Elementi di igiene,' Ediz. iii., p. 540) clearly foresaw the doctrine of pangenesis", as Darwin himself acknowledged in the second edition of *The Variation of Animals and Plants…* (Darwin 1875 vol. 2 pp. 370f. fn. 42); see Martucci (1981).

132 The debated question was if intact egg shells were permeable to the "germs" of moulds which occasionally could be seen developing inside rotting eggs without any visible damage to their surface. Panceri, while still in Pavia, had demonstrated that only under very specific circumstances, moulds could pass through intact shells and reproduce inside the egg.

be "teeming with vibrios". The author concluded that organic matter, left to itself, protected from any germs, would give rise to microphytes (*végétations microscopiques*), while water was necessary for the formation of infusorians (*animalcules infusoires*) (Donné 1866). Pasteur, in his commentary attached to the published note, severely doubted the validity of Donné's procedure, suspecting the introduction of germs during the handling of the eggs. Donné's response was surprisingly caustic. He repeated the description of one of his experiments, with some variation on the original series: He had pierced the yolk (*le jaune*) with a scalpel first brought to red heat in a flame, let about one third of the liquid drip out and replaced it with boiling distilled water, sealing the opening with hot wax. After five days at room temperature, he found the liquid inside the egg teeming with highly agile vibrios; these, he presented as incontrovertible proof for spontaneous generation, as

> *[o]n ne peut pas raisonnablement admettre qu'ils préexistent dans la matière de l'œuf ; j'ai démontré qu'il ne s'en développe jamais dans les œufs abandonnés à leur décomposition naturelle. On ne dira pas non plus, je pense, qu'ils sont contenus dans l'eau distillée (Donné 1867).*

In the spring of 1868, Balsamo and Maggi repeated Donné's experiments. Initially, following the Frenchman's instructions literally, they were able to reproduce his findings. Continuing their observations beyond the immediate establishment of the presence of vibrios, they also described the formation of vesicles containing nucleate granules, which originated by fusion of yolk platelets (*granuli vitellini*): heterogenesis happening under the lens of their microscope. Then, the authors decided to investigate the exact conditions leading to the creation of different forms of micro-organisms, setting up ten more series of modified experiments. They assembled a complex apparatus to control the atmosphere in which the eggs were incubated, rinsing the air in sulphuric acid. In later experiments, the eggs were placed under water inside a vessel ventilated with air passed through sulphuric acid, and then crushed, observing the coagulation of the albumin in the surrounding water. Examining the developing organisms in twenty-four-hour intervals, the authors observed their further evolution, depending on the controlled conditions of each series of experiments, developing from small, rounded *bacteria* and *vibrio*s into filiform *Leptothrix* (M6).[133] As an additional confirmation of their findings, Balsamo Crivelli and Maggi invited their colleague, the physicist Giovanni Cantoni, to examine their experiments (M8).[134] The latter had already undertaken extensive research into the issue in previous years,

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133 The term *leptothrix* (Greek λεπτόθριξ: of fine hair) was intended to refer to a genus of organismic species, though it was mainly a morphological description of protozoans. The form is not Italianised and equally used unchanged in the plural, as is the case with *vibrio*.

134 The resulting paper, published in identical form both in the *Rendiconti* and in *Nuovo Cimento*, has been included in Maggi's official list of publications (M272, under M8), although it exclusively carries the name of Cantoni.

together with Eusebio Oehl and Paolo Mantegazza.[135] And Cantoni continued the use of those "sealed vessels" which were the target of Mantegazza's slight quoted at the beginning of the present chapter. Sure enough, *vibrio*s and *leptothrices* continued to appear in Cantoni's flasks, even less than twenty-four hours after the albumin had been boiled, conforming to the standards of Appert's method for preserving foodstuff (1810)[136], and the vessel sealed. Cantoni also confirmed that the *leptothrix* were developing out of vibrios; he suggested, however, that the vibrios had died and their cadavers given rise to the formation of *leptothrices* (as well as *vibrio* spores); thus, we might speak of a second phase of spontaneous generation. The heat resistance of spores had not yet been investigated; hence, in the 1860s, it was still uncontroversial to assume that the Appert boiling process would reliably destroy all actual living organisms, while it was unclear what extended exposure to very high temperatures did to the potential for life thought to be inherent in organic matter – which only demonstrates how fine the line between materialism and vitalism was where these researchers were treading.[137] Cantoni's results in 1867 are not conclusive in this respect; he does conclude, though, that boiling kills all infusorians and their germs, with an increasing disaggregation of their organic elements, which however are able to re-aggregate at temperatures above 15°C, reconstituting organisms such as the *vibrio*s.

In 1863, the French pharmacologist Jules Lemaire (1814-1886) had described the effects of carbolic acid (*acide phénique*) on various organisms, demonstrating, as he interpreted it, that his solution of 1 g phenol in 1 l of spring water killed all the germs dropping into the liquid from the surrounding air. Balsamo and Maggi used these results in another programme of eleven series of different experiments examining the effects of *acido fenico* on the production of certain inferior organisms (M7). Under certain circumstances, they found carbolic acid even to be favourable to the *ex novo* formation of vibrios, bacteria, and *Hefezellen*[138] – for if the phenol had killed any germs that might have contaminated the solution, these newly found micro-organisms could only have arisen directly from the substances of the sample, and especially from the yolk platelets. The difference in the forms of organisms observed in these experiments was to be explained not only by a variety of external circumstances (temperature, most of all), but the researchers suspected that two types of yolk platelets, proteic and fatty, generated different organisms: bacteria the former, and vibrios the latter. They sought to prove their claim by dissolving either the proteic platelets by adding ether, or the fatty platelets using acetic acid. As expected, solutions from which the bacteria-generating proteic

135 Mantegazza with Cantoni (1865), Cantoni (1865), Cantoni & Oehl (1866, 1866a), etc.

136 Nicolas Appert (1749-1841) had introduced a technique of heating and canning food commercially, see Appert (1811).

137 See, e.g., Farley (1977:121f.)

138 The latter, 'ferment' or 'yeast cells' (*cellule del fermento/del lievito*) having been described by Ernst Hallier in the same year (see Hallier 1867).

platelets had been eliminated only produced vibrios, and vice-versa, the destruction of fatty platelets only allowed for the formation of bacteria. "Microchemical" research showed that the bacteria like the proteic yolk platelets bound carmine dye (and died), whereas vibrios and fatty platelets did not react with the carmine, and several other chemical reactions confirmed the distinction between the two groups of organisms (M11).[139] Beyond these more limited and specific interpretations, the authors conclude on a very general note, speculating (with Charles Robin) about the "possibility to find out some day that the laws regarding the constitution and the actions of these organisms are but particular instances of cosmological laws".[140]

For the following eleven years, Maggi, Cantoni, and initially Balsamo Crivelli (who died in 1874) continued with a broad range of studies trying to clarify the details of heterogenesis, both regarding the conditions that allowed for the generation of organisms from non-organised matter, and the exact mechanisms of this process, including the morphology of the organisms thus originating. The issues raised were several, and they reflected the intricacies of the matter, which made the ongoing researches in various parts of Europe so difficult. In addition to practical criticism, along the lines of our initial epigraph quoted from Mantegazza, it was far from clear conceptually what heterogenesis actually meant: Was it that organic matter possessed some form of vital potential, which might be destroyed by aggressive procedures aimed at eliminating actual organismic life? Was there a significant contribution of (purely physical) Brownian motion to the presumed active movement of granules and globules under the microscope?[141] What was the status of the innumerable micro-organisms described by microscopist such as Christian Gottfried Ehrenberg (1795-1876) and Félix Dujardin (1801-1860)? Were they separate species, even complex organisms with well-differentiated inner organs (Ehrenberg 1838), or were they simple bits of unstructured "*sarcode*" (Dujardin 1841:35ff.), growing into other forms successively?[142]

139 A slightly ironic tone is intentional. Unfortunately, there is no trace of any surviving laboratory notes allowing to conduct a critical background study on the lines of Holmes' and Graßhoff's detailed work on Hans Krebs' elaboration of the citric acid cycle (Holmes 1990, 1991-1993; Graßhoff et al. 2000).

140 "nulla contraddice, come ultimamente scrisse il sig. Ch. Robin, alla possibilità di scoprire un giorno che le leggi relative alla costituzione ed agli atti di questi esseri non siano che casi particolari delle leggi d'ordine cosmologico." (M11:406). Charles Robin (1821-1885), who had presented Donné's controversial spontaneous generation paper (1866) to the Paris Académie, had been the editor, together with Emile Littré, of Nysten's revised *Dictionnaire de médecine, de chirurgie, de pharmacie, de l'art vétérinaire et des sciences qui s'y rapportent* (since the 10th edition, Paris: Baillière, 1855).

141 Giovanni Cantoni, in his main role as a physicist, was intensely interested in phenomena of heat and Brownian motion, see, e.g., Cantoni (1868).

142 On Ehrenberg's "complete organisms", see Hausmann (1996). For a biography of Ehrenberg, see Jahn (1971), for Dujardin in the same volume Geison (1971).

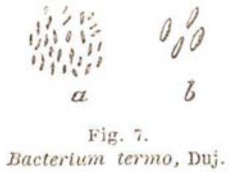


Fig. 6: M121 p. 53

The Pavia group clearly supported the last assumption, observing *leptothrix* growing out of vibrios, just as Ernst Hallier (1867) had described its formation out of small granules – the above mentioned *Hefezellen*, which in Balsamo and Maggi's parlance were the 'embryos' of *Vibrio bacillus* (M9:52) – though their use of the term "embryogenic series" (*serie embriogenica*, ibid.) is not to suggest that they subscribed to Ehrenberg's concept of a metazoan character of infusorians. Two of Dujardin's most common infusorians, *Bacterium termo* and *Vibrio bacillus*, according to Balsamo and Maggi's joint researches, were but transitory forms of microphytes,[143] produced not from germs but by "transformation of a morphological element, to be determined also chemically".[144] This distinction was crucial for the precedence of spontaneous generation over Hallier's "panspermia": While the botanist from Jena stated that germs where universally present, his fellow naturalists in Pavia insisted that the granules described by Hallier as yeast cells were but morphological elements made up of myelin, unstructured organic matter of different types, depending on the "influence of the bodies with which they are united", undergoing a "morphological mutation" as in the development of vibrios and bacteria from fatty and proteic yolk platelets, respectively.[145] Humid incubation of boiled egg yolk solutions with subsequent addition of "a few drops

143 The unequivocal classification of these infusorians as plants provides an indication that Maggi, contrary to his later claims, had not yet assimilated Ernst Haeckel's postulate that living beings should be classed in three distinct kingdoms: the conventional animals, plants, plus the protists, comprising organisms at a low level of organisation which could not be classified as either animals or plants (Haeckel 1866: v. 1 p. 203). See his first letter to Ernst Haeckel, dated 30 Jan. 1884, where he explicitly (perhaps hyperbolically) states that he had been following Haeckel's publications "[s]ince 1866, the time when your *Generelle Morphologie* appeared". It was not until 1874 that Maggi explicitly referred to Haeckel's system (M45). Balsamo Crivelli (1874) concludes his review of Maggi's monograph with reference to Bory S. Vincent's *psychodiaires* (*Psicodiarj*): "a classification which was then modified by the genial and acute naturalist Haekel (sic), who labelled these creatures with the name of Protists." (*classificazione che fu poi modificata dal geniale e acuto naturalista Haekel, il quale appose a questi esseri il nome di Protisti*).

144 […] "dovuta alla trasformazione di un elemento morfologico, determinabile anche chimicamente" (M10:302)

145 "[…] la produzione del microfito è dovuta ad una mutazione morfologica di un corpo costituente la infusione, nell'istesso modo che i Vibrio bacillus ed i Bacterj, nelle soluzioni di tuorlo d'ovo di pollo, sono prodotti da una mutazione morfologica dei granuli vitellini, che ora diciamo dei granuli grassi pei Vibrio, dei granuli proteici pei Bacterj." (M14:567). Maggi's friend and colleague, Achille De Giovanni, performed animal experiments to study the role of Hallier's *Hefezellen* in the causation of disease, concluding that fermentation was a property of substances which have ceased to belong to the organism, as they no longer enter the "circulation of life" (*in quanto non entrano più nella* circolazione della vita; De Giovanni 1869:349). Incidentally, Moleschott's diatribe against Liebig, *Der Kreislauf des Lebens*, had just been translated by Lombroso, precisely as *La circolazione della vita* (Moleschott 1869).

of ammonia water" produced quite complex microphytes, such as the fungus *Botryosporium* (M18). The morphological changes effected at the beginning of the microphytes' "somatic evolution" were then established to depend, in the case of vibrios, on the number of elementary granules for the length, and their diameter for the width of the resulting organism (M20).[146] And more experiments in sealed vessels were to follow, increasingly geared towards defining the physical and chemical conditions under which different chains of organismic development could be triggered. Ten years into the work of the Institute's commission on spontaneous generation, in 1874 Maggi was taking stock of international developments in the field, especially in France (Milne Edwards), England (Bastian and Huxley), and Germany (Haeckel). Maggi's note read to the Institute, "On the distinctions introduced into spontaneous generation" (M46) contains the first explicit references to the ideas of Ernst Haeckel published by Maggi.[147] In his lecture, Maggi collated the different types of spontaneous generation proposed by colleagues abroad, with the intention to calibrate the commission's work against the most recent concepts.

Fundamentally, the authors involved in the debate distinguished between two possibilities of life originating: either from matter that had never been living, be it inorganic or organic; or from parts of organisms which had either died and were decomposing, or were even still alive, but completely unrelated to the newly created organisms. The first process was called *agénie* by Milne Edwards (1868:251), for any formation without contribution from a pre-existing organism, similar to Huxley's *abiogenesis*. Bastian's *archebiosis*, as Maggi points out, was limited to the derivation of organisms from organic fluids independently from living bodies. Haeckel's *Autogonie* (1866, 1:179) explicitly referred to inorganic solutions giving rise to organic individuals. Initially, he was strongly committed to this type of generation, as a foundation of a Monist philosophy proclaiming, among others, the uniformity of developmental processes in the cosmos (Farley 1977:76ff.): at least, "under conditions quite different from those of today, the spontaneous generation which now is perhaps no longer possible, may have taken place".[148] *Plasmogonie*, on the other hand, for Haeckel was the formation of organisms from organic solutions without involvement of living organisms (Haeckel 1866, 2:34), for instance from decaying organisms, sometimes called *generatio aequivoca* (ibid., 1:176) – the latter had been called *nécrogénie* by Milne Edwards (1863). This was, however, what the Pavia group had been studying for over a decade, under the label of heterogenesis, which was also the term used by Henry Charlton Bastian

146 Just to give the reader an idea of the order of magnitude, the platelets measured around 0.0012mm on average, with a variation between 0.0006 and 0.0024mm (ibid.).

147 Together with his monograph on infusorians of the same year (M45), see note above.

148 "*daß zu jener Zeit unter ganz anderen Bedingungen eine Urzeugung möglich gewesen sei, die heutzutage vielleicht nicht mehr möglich ist*". Quoted in Farley (1977:77), from E. Lankester's English translation of Haeckel's *The History of Creation or the Development of the Earth and Its Inhabitants by the Action of Natural Causes*, New York (1876a), vol. 1 p. 342.

(1837-1915) in a slightly different sense (for a more complex organisation of living matter), and with apparent satisfaction Maggi mentions that the Englishman had classified the experiments conducted by Maggi and Balsamo Crivelli among the cases of his own heterogenesis.[149] In Bastian's parlance, however, the formation of very simple organisms from organic matter would be called *archebiosis* – a term Maggi and Cantoni rarely adopted in their researches.[150] In summary, Maggi equates Haeckel's autogeny with Milne Edwards' inorganic ageny (and Huxley's *abiogenesis*), for which relevant experiments had not yet been successfully conducted. Haeckel's plasmogony, on the other hand, was synonymous with Bastian's *archebiosis*, which was the field of experiments undertaken in Pavia. Finally, Maggi proposes a unification of terminology, suggesting to distinguish three possible processes, namely

1) autogeny (Haeckel)
2) plasmogony (Haeckel), and
3) necrogeny (Milne Edwards)

In the following year, Cantoni and Maggi published the results of three experiments with vegetal decoctions (from squash and turnip), conducted in the summer of 1874, which had all produced negative results. But, given the unequivocally positive results obtained in most of the earlier experiments, summarised in three tables in this latest note, the authors insisted to have proved already that heterogenesis was possible, whereas their own and others' negative results only showed that

> *in addition to the conditions we have already pointed out, in order to obtain favourable [sic] results, other conditions need to contribute, of which we are so far ignorant […] We say therefore, and we insist on this deduction, that the question of heterogenesis has not yet been completely resolved, but that [this question] still deserves the attention and effort of scholars".*[151]

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149 Bastian (1871):16. The following year, Bastian writes: "In 1868, Prof. Cantoni, of Pavia, also made some experiments in concert with Profs. Balsamo and Maggi, in which hermetically sealed flasks containing various organic solutions or infusions were heated to temperatures ranging from 100°-117°C (212°-242.6°F), in a Papin's digester." He then goes on to describe the experiments in some detail, over a bit more than a page. It is interesting to note that he had for a long time only known Cantoni's work through secondary references, until eventually the author had sent him some of his papers (Bastian 1872 1:436-7 and notes). Throughout these two volumes, Bastian makes numerous references to Mantegazza, Oehl, and Cantoni, while mentioning Balsamo Crivelli and Maggi only once in each volume (1:436, 2:344).

150 And when they did, they used it almost interchangeably with heterogenesis: In 1876, after Cantoni's meetings with Bastian and Tyndall, they published "More series of experiments into archebiosis" (M57), though these studies followed designs which earlier and later would be referred to as "heterogenesis" (e.g., M66&67).

151 "oltre le condizioni da noi già indicate, per ottenere resultanze favorevoli, concorrer deggiono altre condizioni, da noi tuttora ignorate […]. Diciamo insomma, ed insistiamo su questa

Though this is not the final word on Cantoni and Maggi's heterogenesis research,[152] the note ends on a rare outburst of ideological interpretation, which could well serve as an epitaph; and, given the more recent discord over the role of *weltanschauung* in the Pasteur-Pouchet debate,[153] the passage, though more than half a page long in the original print, deserves to be quoted in full:

> *Indeed, this question had a unique fate. Just after the middle of the last century, we find a good Catholic, Needham,[154] presenting himself as a supporter of heterogeny, and the most celebrated among the naturalists of that time, Buffon, who warmly applies himself to support this idea with his theory of organic molecules:[155] whereas heterogeny is vigorously combated by that strenuous champion of rationalist and anti-theological philosophy, Voltaire, who equally combated, with the inexorable weapon of ridicule, the doctrines of the mutability of species and of successive geological formations, maintained by Buffon. However, around the middle of the present century, we find the most illustrious naturalists, whom we could call official and Catholic, turning into harsh opponents of the theory of the variability of species and of heterogenesis, while the most independent philosophers and naturalists, in the name of free reason, support the genetic doctrine of successive metamorphoses of the stars and of the organised beings.[156] It has to be said, though, that Voltaire, as well as Spallanzani, with their criticism of the adventurous conjectures of naturalists in their time made a great contribution to the progress of experimental science, recommending to devote more attention to the facts and to arm themselves against the charms of hypotheses, that is to say, to reclaim the severe maxims of the Galilean method, which are honoured by today's positive rationalists, too. And we, having faith in the inexhaustible fecundity of the experimental method, we expect new discoveries even regarding the principles of biology and embryology.[157]*

deduzione, che la questione della eterogenia non è stata ancora compiutamente risolta, e che però essa merita ancora l'attenzione e lo studio dei dotti […]" (M50:96; tables on pp. 97, 98, 99).

152 A year later, in April 1876, Cantoni even visited Tyndall in London and discussed his past experiments, which led to a further series of tests which Cantoni, upon his return, conducted with Maggi; see M57.

153 See, on the one hand, Farley (1978) and Latour (esp. his chapter in 1997 [1989]), and his opponent Roll-Hansen (esp. his *Centaurus* paper in 1998).

154 John Turberville Needham (1713-1781) was the first Roman Catholic minister (ordained in 1738) to be admitted, in 1768, to the Royal Society for the Improvement of Natural Knowledge. On his experiments into spontaneous generation, see Roe (1983).

155 We need to keep in mind the changing meaning attached to the term "molecules" as morphological entities, from Needham/Buffon's "organic" to Robert Brown's "active" molecules and beyond (Strick 2000:6-10).

156 The "star" reference is presumably to the nebular hypothesis of planetary evolution, which had come up in the late 18th century, as Rupke (1976:54) mentions.

157 "Per vero, molto singolari furono le sorti di questa quistione. Poc'oltre la metà dello scorso secolo, troviamo un buon cattolico, il Needham, farsi sostenitore della eterogenia, ed il più celebrato tra i naturalisti di quel tempo, il Buffon, che calorosamente s'adopera per appoggiarla colla propria teoria delle molecole organiche: laddove l'eterogenia è combattuta vigorosamente da quello strenuo campione della filosofia razionalista ed antiteologica, che fu il Voltaire, il quale

A significant ambivalence speaks through these remarks: On the one hand, the authors note the irony that their predecessors had formulated theories apparently in contrast with their ideological commitments, a stance which might gain them the assent of today's constructivists. At the same time, they strongly emphasise the "Galilean method" and their own adherence to "positive rationalism", to dispel any possible allegation that their own observations could be anything less than positive facts, unaffected by any ideological expectations. Over the next few years, Cantoni and Maggi's advocacy of spontaneous generation became less outspoken, though for Maggi the possibility of vibrios forming from decaying organic matter remained a distinct possibility, and he could at times become quite defensive about the issue. The nature of cells and the interpretation of the increasingly large number of subcellular structures described during the closing decades of the nineteenth century remained an issue well into the twentieth. As D'Arcy Thompson complained in 1917,

> *Various functions, which seem somewhat arbitrarily chosen, have been assigned, and many hard names given to them; for these structures now include your mitochondria […], your Altmann's granules, your microsomes, pseudo-ergatoplasm, […] and many other histological minutiae.*[158]

In this respect, more than half a century of heterogenesis research had led to a successful research programme, providing an incentive to identify and characterise subcellular organelles, even though this direction had not been intended (or even envisaged) by naturalists committed to a unitarian (and sometimes monist) view of the world. In a more localised framework, Maggi in his heterogenesis experiments had designed techniques which enabled him to identify and observe microscopic organisms, no matter how they were first produced. Maggi never formulated an explicit retraction of his position on heterogenesis, which we will continue to encounter in the next chapters, though with less and less prominence in the natural history of various microbes, while practical aspects are increasingly coming to the fore, both positive (fermentation) and negative (pathologies).

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combatteva altresì coll'inesorabile arma del ridicolo le dottrine della mutabilità delle specie e delle successive formazioni geologiche, sostenute pure dal Buffon. Invece, verso la metà del secolo presente, troviamo i più insigni naturalisti, che diremo officiali e cattolici, fatti aspri oppositori delle teorie della variabilità delle specie e della eterogenesi, nel mentre i filosofi ed i naturalisti più indipendenti sostengono, in nome della libera ragione, la dottrina genetica delle successive metamorfosi degli astri e degli esseri organizzati. Ma è da avvertire che, tanto Voltaire, quanto Spallanzani, criticando le ardite congetture dei naturalisti del loro tempo, molto contribuirono al progresso della scienza sperimentale, col raccomandare di mettere maggiore studio ai fatti e di premunirsi contro gli allettamenti delle ipotesi, ossia col richiamare le severe massime del metodo galileano, alle quali fanno omaggio anche i razionalisti positivi d'oggidì. E noi, che abbiam fede nella inesausta fecondità del metodo sperimentale, ci attendiamo nuove scoperte anche sui principj della biologia e della embriologia." (M50:101).

158 D'Arcy Thompson (1917): *On Growth and Form*, quoted in Olby (1986):275.

From Monera to Haeckel (1866-1905)

> I consider spontaneous generation, or heterogenesis, as a separate branch of experimental biology, which studies the natural history of the production of organised beings, researching its modalities, and thus not to confound with the study of the modalities of their reproduction (M45:33).[159]

Virtually every publication dealing with Leopoldo Maggi has stressed his close intellectual relationship with Ernst Haeckel, which on the whole is undeniable, and supported by Maggi's own testimony as well as in his work. Yet, the beginning of this assimilation of Haeckel's concepts and ideas was not as instantaneous as Maggi later wanted to believe (or make believe). His work in protistology allows us to follow quite closely the sequence and timing of Maggi's acquaintance with individual items from Haeckel's *œuvre*. We will therefore follow the line of Maggi's research during the 1870s and early 80s with particular attention – with the added

[159] "[…] io considero la generazione spontanea o *eterogenia*, come un ramo a sé di biologia sperimentale, il quale studia la storia naturale della produzione degli esseri organizzati, ricercandone le modalità di riproduzione loro […]"

benefit of a *tour de force* through the European research landscape, to which Maggi continued to pay close attention.

Some seven years into Maggi's publishing experimental research of the "production of organised beings", a new focus of his research is developed: the natural distribution and natural history of "inferior organisms", and of freshwater infusorians in particular. His first major work in this field, a monograph of 160 pages with eight lithographic plates, had initially been conceived as a series of articles for the monthly magazine *Il Convegno*, but it was decided to publish the work in its entirety, because 'the subject matter was indeed special, and the illustrations and tables could be fitted more profitably in a monograph', as the editors pointed out (M45: before p. 1).[160] Maggi prefaces his work with vivid descriptions of the variety of habitats where lower organisms have been found, and it is hard not to see his geological field work experience in the foothills of the southern Alps transpire in his enthusiastic depiction, though he goes far beyond the realm of his personal experience:

> *At the foot of mountain ranges as on their summit, in polar ice as in alpine glaciers, on the edge of swamps as along the beaches of the ocean, on its surface as in its depth, in sweet and freshwater as in mineral and thermal waters lower organisms have been found; and these have chosen their abode not only on the earth and in the water, but also on other organised beings and in the most varied inner parts of animals and plants (M45:1f.).*[161]

Of these *esseri inferiori*, Maggi is only dealing with the zoological group of infusorians, excluding other forms which in the past had been treated jointly with the former, such as "insects and their larvae, branchiopod crustaceans or entomostraca, systolids, certain worms and zoophytes, and also the rhizopods".[162] He begins his account with a review of the dominant ideas regarding the structure of infusorians, discussing Ehrenberg's polygastric theory (which he regards as obsolete), Dujardin's sarcode, unicellular theories proposed by Franz Julius Meyen (1804-1840), Karl Theodor von Siebold (1804-1885), Albert von Kölliker (1817-1905) and others, and Maximilian Perty's (1804-1884) theory of a combination of

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[160] According to the on-line catalogue of the Italian National Library in Milan, *Biblioteca Nazionale Braidense,* the magazine only appeared in four volumes between 1873 and 1874: *Il convegno: raccolta mensile di studi critici e notizie*. Milan, 1873-…; http://opac.almavivaitalia.it/braidense/result.php?bid=TO00182129, last accessed May 2008.

[161] "Ai piedi delle catene montuose come sulla loro sommità, nei ghiacci polari come sui ghiacciai alpini, ai bordi degli stagni come lungo le spiagge dell'oceano, alla superficie di esso come nelle sue profondità, nelle acque dolci e fresche come nelle minerali e termali si |2| son scoperti *esseri inferiori*; e questi, non solo sulla terra e nelle acque, ma ancora sopra altri esseri organizzati e nelle più svariate parti interne degli animali e vegetali, hanno scelta la loro dimora."

[162] "gli insetti e le loro larve, i crostacei branchiopodi od entomostracei, i sistolidi, alcuni vermi e zoofiti, ed anche i rizopodi" (M45:2). On the *systolides*, see Dujardin (1841:571ff.); the group is generally known as rotifers (*Rotatoria*); cf. M86.

incompletely developed cells.[163] The complexity of infusorian organisation remained a major issue, and we have seen, in the previous chapter, that the Pavia group did not even use the term "cell", with its association of denoting a unit of individuality, in their work on the "production of lower beings". Rather, granules, vibrios, leptothrices, etc. were regarded as transitory stages of continuous transformation, whereas the natural history of these beings, once produced, did require the assumption of some degree of stability in their reproduction. Maggi in his treatise discusses the fine anatomy of infusorians and their various organ system without further insisting on the unicellularity debate,[164] actually, without further regard for cells altogether. In the discussion of reproduction, he gives ample space to the proponents of a simple division (*divisione spontanea, scissiparità,* or *fissiparità*), which had already been described by Abraham Trembley in hydra polyps well over a century earlier, despite of the obvious difficulties of such a process in a complex organism (M45:16f.). But just how common was this process among infusorians? In the end, he approvingly quotes from an early work by Mantegazza (1852:470), who, in youthful verve, had claimed that "for over fourteen months, I have observed millions of infusorians of all the species, and I only recall two or three cases in which I saw an infusorian divide in two under my eyes".[165] Other possible forms of reproduction include budding (*gemmiparità*) or the formation of embryos. Eventually, Maggi discusses the possibility of sexual reproduction – Ehrenberg had described infusorians as hermaphrodites, containing both male and female sexual organs. The French embryologist Edouard-Gérard Balbiani (1823-1899) believed that the nucleus represented an ovary, while a nucleolus in its vicinity was a testicle. Both organs tended to dissolve and become invisible except during the period of copulation, which could take from one to several days to accomplish. Samuel Friedrich Stein (1818-1885), however, observed sperm in the nucleus, too, concluding that spermatozoa from the nucleolus passed directly to the nucleus, which then, fertilised, cleaved into ovules.[166]

In the following section on the movements of infusorians, Haeckel makes his entrée, with his *Biologische Studien* (1870),[167] and Maggi has to address cell theory

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163 Perty, Maximilian (1852): *Zur Kenntniss kleinster Lebensformen nach Bau, Funktionen, Systematik, mit Specialverzeichniss der in der Schweiz beobachteten.* Bern: Jent & Reinert, (M45:6f.).

164 It was not until 1873 that Ernst Haeckel definitely committed to von Siebold's view that the Protozoa were unicellular organisms; see Cole (1926):34.

165 "Io ho osservato per più di quattordici mesi dei milioni di infusorii di tutte le specie, e mi ricordo appena di due o tre casi nei quali vidi un infusorio dividersi in due sotto i miei occhi." (Mantegazza 1852:470, original spelling). Maggi shows a remarkable trend to use obsolete or non-standard forms in his writing; thus, in the present quote he writes: "viddi un'infusorio", M54:19).

166 The "hermaphroditic theory" and Stein's objections are discussed in Churchill (1989:197-204). The observation of spermatozoa in infusorians goes back to Johannes Müller (ibid., 198f.).

167 and not with the major *Generelle Morphologie* of 1866, as Maggi's letter to Haeckel (30 Jan. 1884) suggested; in the bibliography of the infusorian monograph, Haeckel is not listed (M45:133f.).

once more: For Haeckel, "*the ciliary movement is but a modification of the amoeboid movement of protoplasm*".[168] In the absence of a distinctive membrane to which cilia had been thought to be attached, Haeckel described the cilia and flagella as an extension of the protoplasm and derived ciliate cells from transformed amoeboid cells (M45:43). In 1873, however, Haeckel accepted the single-cell character of infusorians,[169] but it appears that Maggi had not yet seen the new work in the *Jenaische Zeitschrift*.[170] Maggi returns to Haeckel once more, at the end of his text, with a short, but essential passage: Maggi explains how Haeckel, against the established system of Claparède and Lachmann, reorganised the phylogenetic system of infusorians. At a moment, when the boundary between the animal and plant kingdoms were becoming blurred by the study of lower organisms, it would have been unclear "where to posit the infusorians, had not usefully appeared the modifications which Haeckel had introduced in the subdivisions of the entire class of infusorians".[171] These modifications were actually quite revolutionary, in that Haeckel postulated a separate kingdom for some groups which had previously been included in the *infusoria*, i.e., the flagellates, which now came to be known as *Protists*, whereas the ciliates and *suctoria* remained under the name of infusorians in the animal kingdom.[172] Maggi proceeds by translating four full pages of Claparède and Lachmann's arguments in favour of the animal nature of all infusorians, only to return to Haeckel's phylogenetic arguments for a separate kingdom, interspersed with some unattributed experiences of heterogenist persuasion, some clearly pointing to the experiments conducted in Pavia. Against Haeckel's professed belief in spontaneous generation (*sensu*: abiogenesis) of monera, the simplest forms of life,[173] Maggi insists on the reality of heterogenesis in

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168 "*il movimento ciliare è unicamente una modificazione del movimento ameboide del protoplasma*" (M45:43, italics L.M.)

169 Churchill (1989:204). The reference is to Haeckel (1873); see also Cole (1926:34), as cited above.

170 The work also circulated as an offprint, sold by the Leipzig publisher Engelmann.

171 "Ed ancora non si saprebbe dove porli, se in oggi non si presentassero utilmente le modificazioni introdotte da Haeckel nelle suddivisioni di tutta la classe degli infusorj." (M45:65).

172 (M45:66). This does not mean that Haeckel would have been the first to create another category beyond animals and plants; Bory de Saint Vincent's *psychodiaires* have already been mentioned. But Haeckel's Protista were distinguished by a far lower degree of apparent organisation than the *psychodiaires* and other previously suggested groups, see Rothschild (1989). For a quick orientation in the history of protozoan classification, see Corliss (^{2}1979:6-7).

173 Haeckel uses the neutral form *das Moner* in German; in *Generelle Morphologie* (1866), he applies the Graeco-Latin plural *moneres*, which cannot be neuter; in *Natürliche Schöpfungsgeschichte* (1868), he switches to the Latin neutral plural *monera*. Lankester's English translation of the latter invents a pseudo-Greek singular, *moneron*, which Haeckel did not use. The neutral form of the Greek word, which Haeckel correctly cites in the *Generelle Morphologie*, would be sing. monēres, pl. monērē (Haeckel 1866, 1:135 n. 1; he uses the masculine form μονήρης). To complete the confusion, as the Italian language does not have a neuter, the word becomes masculine (*il monere, i moneri*), but soon a feminine version develops (*la monera, le monere*). Feminine forms also appear in other languages; in English, it seems that *monera* tends to be used as a singular form (like *data*?), although *moneron* continues to be used, e.g., in Richards (2008), *passim*.

infusorians, though he has to admit that such a way of origin would contradict Haeckel's phylogenetic model, where infusorians should be descendents of monera, while Maggi could only attest to the heterogenesis of higher forms, not of monera themselves.

To sum up, Maggi's lavishly illustrated monograph, though aimed at a non-specialist readership, provided a fair reflection of the ongoing debates about the nature and reproduction of infusorians, at a fairly advanced technical level, while, as we have heard at the beginning of this chapter, he chose to avoid the issue of spontaneous generation, though he continued to pursue this question, together with Giovanni Cantoni, with a several more series of experiments.[174] Conceptually, Maggi elaborated on Haeckel's plastid theory, tracing back the unit of life below the level of cells to the elements from which, according to Haeckel, those cells originated. As Maggi described in 1875 (M51), the experiments he had conducted with Balsamo Crivelli and Cantoni in the preceding decade had demonstrated the creation of non-nucleate, non-membranous hyaline homogenous spheres (plastids: gymnocytodes), which would then give rise to membranous non-nucleate lepocytodes by condensing the outer part of the plasma or secreting a membrane, or evolve into nucleate gymnocytes by thickening their central plasma into a nucleus. Finally, lepocytes would develop out of either lepocytodes by formation of a nucleus, or from gymnocytes by formation of a membrane (ibid., 75a).[175] In conformity with Haeckel's biogenetic law,[176] Maggi then extended the ontogenetic line to start with the monerula, corresponding to the monera phylogenetically, representing a gymnocytode, progressing towards the ovulum or nucleate animal egg in ontogeny, at the phylogenetic stage of Autamoeba, which would represent a gymnocyte. With the following table, Maggi tries to clarify the terminological complications (translated from his article in the *Gazzetta Medica Italiana – Lombardia* of 1875):

174 The last publication listed by Maggi (in M272) under the rubric of "Plasmogony/Heterogeny" is a joint note with Giovanni Cantoni, significantly 'on the limit of productivity in organic solutions'. M74 (1878). However, issues of generation did come up in later work, notably in the context of his plastidular theory, which was based on presumably spontaneously generated plastidules (M85).

175 See Haeckel (1866) 1: 269-289.

176 First formulated in Haeckel (1866) 2: 300. On the philosophical influence of Johannes Müller on Haeckel's biogenetic law, see Krauße (1992):235.

Tab. 2: translated from M51:col. 76a.

Hierarchy		Ontogeny		Phylogeny	
Developmental stages of the animal organism		Stages of individual evolution		Stages of phyletic or genealogical evolution	
2nd stage of development	*Gymnocyte* (Plastid with nucleus)	2nd stage	*Ovulum* (animal egg with nucleus) (simple ovular cell)	2nd stage	*Autamoeba*
1st stage of development	*Gymnocytode* (Plastid without nucleus)	1st stage	*Monerula* (animal egg without nucleus)	1st stage	*Monera*
Plasmogony					

But the emphasis of Maggi's work in the late 1870s quickly shifted towards the natural history of protists, "the modalities of their reproduction". A puzzling observation was that of "conjugation" (*coniugazione*) or "zygosis" (*zigosi*), reported widely by researchers such as Léon Leclerc,[177] Dujardin, Claparède and Lachmann, Kölliker, Cohn, Bütschli, and many others. These terms, the synonymy of which was debated,[178] applied to the observed process of two individuals' complete fusion, to form a new unitary organism. Leopold Auerbach (1828-1897) had however hesitated to decide if his observation of two amoebas "joining" was an incidental cohesion (*zufälliges Aneinanderhaften*), the process of division (*Theilungsvorgang*), or a conjugation (*Conjugation*).[179] From his own observations, Maggi speculated that the conjunction of amoebas was the prelude to reproduction by sporogeny: He saw moving granulations inside an amoeba which he thought to be the result of a conjugation, and after a while, the movement stopped, and the "amoebic cyst" (*la cisti amibica*) broke up, releasing the "granules which looked like spores".[180] This discovery led Maggi to support the opinion that

177 He depicts a presumed *accouplement*, regretting that "one is always limited to suppositions with these infinitely small" (il est triste d'en être toujours réduit aux suppositions avec ces infiniment petits). Leclerc (1815): 478 and Pl. 17 no. 4.

178 Claparède and Lachmann used conjugation for algae only, while following Ehrenberg in applying "zygosis" to protozoans, but Stein rejected this distinction (M58:436 and notes).

179 Quoted in M58:437, from Auerbach's paper 'Ueber die Einzelligkeit der Amoeben'. *Zeitschrift für wissenschaftliche Zoologie* 7 (1856):400.

180 "…avente ciascun granulo l'aspetto di una spora." (M58:440). This was not dissimilar to Balbiani's earlier ideas, which Stein had however challenged, as he observed the separation of conjugants before any spermatozoa had been formed; see Churchill (1989): 201.

amoebas were actually autonomous organisms, with their own reproductive cycle, rather than developmental stages of other lower organisms, as Leuckart, Leydig, and Lieberkühn had argued (M60:417ff.). Physiologically animals, amoebas might or might not be enclosed in a membrane, as Haeckel had pointed out in his *Biologische Studien* (1870). By now, Maggi quoted explicitly Haeckel's *Zur Morphologie der Infusorien* (1873), where the latter stated that all infusorians were to be considered unicellular organisms.[181] Maggi then continued further along the path "from the cell theory to the theory of plastids", as he wrote in 1875 (M51), studying the development of the basic cell-forming substance, Haeckel's *plasson*,[182] the undifferentiated precursor of both protoplasm and nuclei. In 1877, Maggi summarised the definition Haeckel (1872) had provided in his monograph on calcareous sponges:

> *The plasson equals the protoplasm plus the nucleus; the protoplasm equals the plasson minus the nucleus; and the nucleus equals the plasson minus the protoplasm. Chemically, the plasson is a carbonic compound, the so-called primitive mucus (Urschleim to the Germans); morphologically, it is the first form-giving element of the organisation, or a cytode; zoologically, it is a first living being, a protist, or a moner.*[183]

Maggi observed that, in the process of differentiation, the *plasson* could form a nucleolus, sometimes prior to the formation of a nucleus (M61). This struggle for the unity of life continued over the coming years: Again with recourse to spontaneous generation experiments, Maggi generated, from an organic emulsion, fine granulations displaying active motion, which ended when the granules had reached a regular disposition, which Maggi interpreted as a pattern corresponding to Auerbach's karyolitic forms, or the "molecular stars" of other embryologists.[184] Over a few days, these original structures evolved into higher forms, such as *Aspergillus*, whose

181 Maggi's note was read on 30 July, 1876.

182 In his Generelle Morphologie (1866, **1**:276 n.1), Haeckel discusses but still dismisses the term "Plasson (τὸ πλάσσον) das Bildende, das Formende".

183 "Il *plasson* […] è eguale al *protoplasma* più il nucleo; il *protoplasma* è eguale al *plasson* meno il nucleo; ed il nucleo è eguale al *plasson* meno il *protoplasma*. Chimicamente considerato, il *plasson* è un composto carbonioso, ossia il così detto *muco primitivo* (*Urschleim* dei Tedeschi); morfologicamente è il primo elemento formatore dell'organizzazione, ossia un *citode*; zoologicamente è un primo essere vivente, un *protisto*, ossia un *monere*. M68:361.)

184 A brief quote from Churchill's article (referring to a slightly earlier episode) may serve as a timely reminder against the pitfalls of anachronism: "It is easy to smile at the missed opportunities: 'spermatozoa' instead of chromosomes or spindle filaments, 'fertilization' instead of karyokinesis, nuclei and nucleoli instead of macro-and micronuclei, and gonads rather than nuclei within single-celled organisms – but we must not forget the peculiar mindset of the protozoologist in 1859" (ibid., 201). We might go a step further: The issue was not so much a "peculiar mindset" at the time, but on the contrary, neither the concepts of chromosomes etc. were available, nor was the mechanism of propagation among infusorians at all clear, as we have seen in the main text.

> *mycelia are forming by fusion of the protoplasmatic globules or granules, arranged in long linear series, in the same way that* Vibrio bacillus Duj. *is forming from the platelets in egg yolk, which, in the egg cell, are its protoplasmatic granules.*[185]

These experiments demonstrated, in Maggi's view, not only that there were living units below the level of Haeckel's plastids, which Maggi described with the diminutive form of "plastidules", but he had also shown that these plastidules could exist on their own, as *plastiduli liberamente viventi* (M84), which, in his view, allowed them to be considered as organismic individuals. Thus, even Haeckel's simple Gymnocytode (a protoplasmic organism without integument or nucleus) was "constituted, in its turn, by plastidules".[186] In his opening speech at the 1878 congress of the *Società italiana di scienze naturali* in Varese, Maggi took the opportunity to remind the assembled *élite* of Italian naturalists of the heterogenesis experiments conducted in Pavia.[187] In an extensive discussion in front of the numerous scholars participating, Maggi proposed to redefine Haeckel's *Tachymonera*, the simplest life forms then known to zoologists (which included the vibrios), as *Protomonera*, "all the more, as during plasmogony, or the production of organisms from organic infusions, these are the first to appear".[188] These simplest, "bacterial forms" (*forme bacteriche*), were thus the partial (independent) bionts corresponding to the virtual bionts (plastidules) which made up the actual bionts, which is to say, protoplasmic organisms composed of plastidular granules.[189] Later references to Maggi's acrobatic terminology do indeed criticise the author for a perceived lack of clarity, although all one could say about this particular approach is that it betrays a rather deductive approach at the creation of logical systems, rather than strict adherence to the positivist creed of induction from factual observation. One of Maggi's students at the time, Giacomo Cattaneo, continued the discussion of cellular and organismic individuality along the lines sketched by

185 "i micelj si formano dalla fusione dei globuli o granuli protoplasmatici, disposti in lunghe serie lineari, a guisa della formazione del *Vibrio bacillus* Duj. dai granuli vitellini del tuorlo d'uovo, che nell'ovo-cellula sono i suoi granuli protoplasmatici" (M85:819).

186 "Ora un citode od una cellula, ossia un plastide, sarebbe costituito alla sua volta da plastiduli." (M84:326). For a brief discussion of the plastidular theory elaborated by Maggi between 1875 and 1878, see also Dröscher (1996:92f.).

187 The relevant passage contains another instance of his recurrent distancing from Mantegazza, who had still been in Pavia performing experiments on heterogenesis at the time of Maggi's graduation and beyond, and yet, Maggi explicitly excludes Mantegazza from the list of researchers he had "had the honour of collaborating with", namely, Balsamo Crivelli and Cantoni (M78:293).

188 "Tanto più che nella plasmogonia, ossia nella produzione di organismi da infusioni organiche, essi sono i primi a comparire" (M84:329).

189 "ogni plastidulo considerato come bionte virtuale d'un bionte attuale, trova nelle *forme bacteriche* il suo corrispondente bionte parziale." (ibid.).

Haeckel and Maggi, arriving at even more intricate theoretical systems.[190] The impact of this line of research has been reviewed sceptically by Ariane Dröscher (1996:92-94). Even when at the end of the century protoplasmatic granulations were more widely debated, she writes, "Maggi's contributions were hardly taken into consideration" (ibid., 94.) Her reservation regarding the resonance of Maggi's plastidular theory may be debatable: As we have seen, Bastian had been quite taken by Maggi and Cantoni's initial work in heterogenesis, and the plastidular theory was discussed around 1900 by Maggi's student Achille Monti (1863-1937) in the context of turn-of-the-century pathologies (Monti 1900:138-140), stressing the parallels with Altmann's concept of the bioblasts, in a book that the 'New Sydenham Society' had translated into English.[191] Two of Maggi's students, the brothers Zoja, had conducted extensive researches in response to the first edition of Altmann's book (1890), where they pointed out the relevance of Maggi's plastidular theory to Altmann's postulated *bioblasts*. Richard Altmann (1852-1900) acknowledged the work of the Pavia group when preparing the second edition of his *Elementarorganismen*. There he approvingly referred to the results obtained in Maggi's laboratory, which he had come to know through a memoir which the brothers Zoja had published in the *Memorie dell'Istituto Lombardo*, where they pointed out that Maggi's microscopic *plastiduli* (and not Haeckel's invisible *Plastidule*, which Maggi suggested to name biomores) actually corresponded to Altmann's bioblasts.[192] Monti's prize-winning study, in which the author identifies Maggi's plastidules with "ferments" and "enzymes" interchangeably, provides an interesting glance from the distance of two decades, during which the plastidules have survived (or been revived, at any rate), in various incarnations as "*virtual micro-organisms*, subject to a continuous material exchange, – capable, therefore, of giving rise to the phenomena of fermentation" (Monti 1900:161). He goes on pointing out that

> *[i]ndeed, for a long time the enzymes, under the name of ferments, were confused with the zymogenic micro-organisms. Now they are clearly distinguished, since the enzymes can be*

[190] On Cattaneo, see Landucci (1996 s. v. Cattaneo Giacomo):541-545. Cattaneo also elaborated another of Haeckel's key concepts, that of the fundamental forms (*Grundformen*). On the former, see Cattaneo (1879), on the latter idem (1883a).

[191] The Italian original of Monti's treatise was awarded the prestigious *Premio Cagnola* by the *Istituto Lombardo* and had been reviewed very favourably by Pagel in Virchow's *Jahresbericht* (Pagel 1898:321), as Maggi reported, on the occasion of the English translation, in the meeting of the *Istituto Lombardo* on 28 March, 1901 (*Rend*² 34:441).

[192] A German translation of their paper appeared in the same year in the *Archiv für Anatomie und Physiologie*: Zoja & Zoja (1891a). Altmann cites both versions (²1894:42f.). Luigi (1866-1959) and Raffaello Zoja (1869-1896) were the sons of the anatomist Giuseppe Zoja. On the biomores (*biomori*), see M154, the summary of Maggi's course in "Comparative anatomy and physiology (with a morphological approach)" held in 1883/84. In 1895, Maggi described the Zojas' staining technique, based on Altmann, and the results of their studies in detail in his manual on *Tecnica protistologica* (M217:260-264), reiterating, on the occasion, his own plastidular theory.

> *separated from the organisms which have elaborated them, and, once isolated, they are capable of exercising their action in a completely independent way (Monti 1900:162).*

This quote shows how far concepts of sub-cellular elements had changed over the last quarter of the nineteenth century. But we also need to consider that Maggi had been formulating his theory exactly in the crucial period when the entire setting of the spontaneous generation debate was changing dramatically: Cohn's description of heat-resistant spores helped opponents of spontaneous generation explain some of the results of heterogenist experiments, *Bathybius Haeckelii* ceased to exist as an accepted organism, and Tyndall's successes in cleaning the atmosphere and destroying Cohn's spores by repeated boiling finally discredited spontaneous generation of the Bastian and Pouchet type.[193] Therefore, ultimately, it is only fair to say that the Pavia school had been part of a valid international research programme, though it turned out to be unsuccessful in its initial form.

In the mid-1870s, Maggi also began to study the taxonomy and geographical distribution ("chorology") of individual infusorian species in more detail. His first subject was a small ciliate, which Christian Ludwig Nitzsch (1782-1837) had classified as *Urocentrum turbo*.[194] Maggi's paper (M52) is his first taxonomic study in the realm of *infusoria*,[195] discussing morphological criteria for the definition of a family, the next category up from the *genus Urocentrum*; against Claparède and Lachmann's separate family of *Urocentrina*, Maggi argues for the inclusion of *Urocentrum* in the family *Cyclodinea* (Stein) – minutiae of the taxonomist, which Maggi so far had not shown much inclination to engage with. He went on to produce a whole series of faunistic surveys, including one on Lombard freshwater rhizopods (M59), in which he discussed the various systematic modifications Haeckel had proposed in his habilitation monograph on radiolarians (1862) and the monograph on monera (1869).[196] Now convinced of the infusorians' unicellularity, Maggi expressed his wonderment about the degree of physiological perfection reached by an isolated cell, as in the case of the ciliates, of which he decided to establish a catalogue of their presence in different parts of Lombardy, from near Maggi's residence in Pavia (M53) and his native Valcuvia (M62) to the regional capital Milan (M63). Finally, he sought to establish the presence of monera in Italy, a group of particular scientific importance to him, being a prime example for the validity of the theory of plastids and cytodes, which, as he emphasised, "in no way destroyed the other, so-called cellular [theory], but on the contrary, extended its range immensely":

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193 See Crellin (1966), Farley (1977):135-137.

194 First described by Otto Friedrich Müller (1730-1784) as *Cercaria turbo*.

195 As we have seen, he had actually begun his zoological career with a taxonomic work, on the annelid genus of *Aeolosoma* (M4).

196 The latter was also included, with additions, in *Biologische Studien* (1870), the first of Haeckel's works to be cited by Maggi in his own monograph on the infusorians in 1874 (M45, see above).

> *What it does destroy is the aphorism:* omnis cellula e cellula*, because the cell originates from the cytode; and this destruction is as well, in that aphorisms always end up becoming prejudices, which continually obstruct the free course of science.*[197]

Though Maggi continued to use his biogeographical work to debate fundamental issues concerning the formation of microbes, his emphasis markedly shifted towards their detection and taxonomic identification. Having assembled a significant body of work, the opportunity had come for Maggi to take stock of his protistological studies generated during the last few years. In 1877, he produced a collection of fourteen previously published memoirs in a book by the title *On the Protozoans of Italy* (M72), which included some work on heterogenesis, but focused mainly on the faunistic surveys and some morphological studies done on individual species of protists. The title is remarkable, in that Maggi still uses the established term "protozoans", suggesting an animal nature for these organisms, while in his specialist analyses he has already adopted Haeckel's postulate of a protist kingdom separate from the animal and plant kingdoms. It was not until the following year, and in a context new to himself, that Maggi elevated the name of "protist" to the level of a title, not only for an article, but for the elective course in "medical protistology", which he created in 1878 and continued to teach for the rest of his career, even after his research interests had moved away from those tiny organisms towards the largest animals, vertebrates and mammals, in particular.[198]

The year 1878 also saw the last special publication on heterogenesis proposed by Maggi and Cantoni (M74), third of a series begun the year before (M66, M67). Though they never explicitly disowned the claim to having demonstrated the reality of spontaneous generation, the issue faded from their agenda; nevertheless, in 1884 Maggi published another, lengthy memoir reviewing their earlier joint researches, with particular regard to the influence of high temperature on the development (*sviluppo*) of microbes, rather than their generation (*generazione*, *genesi*, *produzione*), as the Pavia authors used to write in the original publications (M143). Also, the plastidular theory advocated by Maggi at the Varese congress of the *Società italiana* and further developed in subsequent studies and lectures is at least consistent with heterogenesis. However, given Cantoni's personal contact not only with Bastian, but also with Tyndall, it is hardly surprising that the remaining members of the Pavia group became far less outspoken with regard to a concept which had lost attraction considerably, though they clearly did not consider spontaneous generation to have been decisively refuted. The distinction between "production" and "reproduction" of organisms, quoted in the epigraph to this chapter, provided Maggi a highly elegant means to study the latter without having

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197 "Ciò che si distrugge è l'aforismo: *omnis cellula e cellula*, perché la cellula proviene dal citode; e questa distruzione sta bene, in quanto che gli aforismi finiscono sempre col diventar dei pregiudizj, i quali ostano continuamente al libero cammino della scienza" (M68:371).

198 *Boll. sc.* 1.1 (1879): 16; see next chapter.

to make strong commitments to the modalities of the former, and thus he continued to study the morphology and distribution of protists, both from a general biological and, increasingly, from an applied medical perspective.

Even in his little textbook on protistology, which made his field known to a wider readership in Italy, Maggi was very cautious with regard to the "production" of protists, although his descriptions of "artificial infusions" to be prepared for the observation of these micro-organisms, which we will later find repeated in his manual of protistological techniques in 1895, clearly imply some kind of heterogenesis.

Medical Protistology

The role of microbes in the aetiology of various diseases, though long suspected, was established with lasting success during the years around 1880, with the noted works by Robert Koch (1843-1910) on tuberculosis and cholera and Louis Pasteur's experiments with rabies. Less noted was the suggestion made by Edwin Klebs (1834-1913), who at the 50th *Naturforscherversammlung* in Munich 1877 had proposed three criteria to prove a microbial genesis of infectious diseases, which came very close to Koch's famous postulates developed and formalised between 1878 and 1884. Clearly, the causative role of microbial agents in the development of disease was a topic of particular interest to pathologists as well as comparative anatomists, who benefited from the technological and conceptual advances achieved during the acerbic spontaneous generation controversy which had dominated the previous two decades of microbial research and which, in itself, had lost almost all its momentum after Cohn's and Tyndall's demonstrations of heat-resistant spores and their destruction by repeated boiling (Farley 1977:140).[199] The heterogenetic or abiogenetic research programmes were thus largely discredited after 1880, but the skills and insights produced in its pursuit remained productive, with a different aim in view, namely, the pathological relevance of microbes.

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199 Farley's classical work (first published in 1974) remains unsurpassed as a general overview for the course of this controversy. On Koch, see ibid. pp. 145f.

The case of Maggi's career suitably illustrates this transformation. Despite of his medical degree, Maggi initially had not shown any interest in the pathological dimension of his research, even while he had begun his research working with a renowned pathologist, Paolo Mantegazza. The ideologically charged issue of the formation of living organisms from non-living organic matter had been the Pavia group's main concern, as we have seen in the previous chapter. The discovery of those most primitive life-forms in nature mainly served to bolster their theories primarily derived from laboratory experiments, and with Haeckel's protist taxonomy in hand, Maggi then went out to collect appropriate specimens in the surrounding terrain of Lombardy. It was in these environments that Maggi eventually did get involved in questions of health, and, more specifically, public hygiene. The Alpine lakes, where he went fishing for freshwater protists, were not just untouched wilderness, but increasingly had to serve as drinking water reservoirs for the growing towns and cities further south. After unification, the north of Italy entered the race towards industrialisation, which also increased the demand for reliable water supplies. Scientists were called upon to support national development: The emphasis on usefulness is expressed in titles such as that of Grassi's chronicle of Italian biology, *Progress of biology and its practical applications* (1911), where in fact the applied disciplines take up far more space than basic research.

In the 1870s, a great number of Italian labourers were employed in neighbouring Switzerland, where a railway tunnel was built under the Gotthard massif. Many of the workers were affected by a severe disease, known as "miner's cachexia" (or, in the local manifestation, "St. Gotthard anaemia"). Doctors suspected that this condition might be caused by a parasite, the hookworm *Anchylostoma duodenale*, first described in 1843 by Pavia graduate Angelo Dubini (1813-1902), who at the time of this discovery had been working at Milan's *Ospedale Maggiore*. The lifecycle and possible transmission of this helminth, however, was not completely known, and its connection to the pernicious anaemia unclear. In 1878, two of Maggi's students, Corrado Parona and Giambattista Grassi studied the lifecycle of this agent, and it was this work that prompted Maggi's first publication on an explicitly medical subject (M75). Only in 1882, just in time for the opening of the tunnel, Maggi's students and colleagues were able to demonstrate that *Anchylostoma* was indeed the cause of this severe disease claiming numerous lives among the workers, to be cured effectively by administering vermifuge drugs, which significantly improved the health situation in later projects of similar nature, such as the construction of the Simplon tunnel between Switzerland and Italy at the turn of the twentieth century.[200]

Regarding the type of organism (a metazoan), Maggi's interest can be seen as one of his occasional diversions resulting from circumstance, usually connected

200 Belloni (1972), id. (1978).

with his commitment to the museum collections and his general teaching of comparative anatomy and physiology, as in the cases of frogs' veins (M82) or birds' hearts (M83) in the same year. The medical perspective, however, was there to stay: From the next academic year, as we have just mentioned, Maggi offered a successful course in medical protistology, which drew attendance from medical students as well as from those in natural history.[201] Already in 1871, he had taught a "precursor" to this topic, which he had then called "experimental heterogeny", but it took him another seven years to design the final course, which he would then continue to run for the rest of his academic career.[202] He published an outline of his course in the December issue of the first volume of his *Bollettino* (M90). From this programme, it appears that the course, though mentioning pathological implications, was predominantly oriented towards the general natural history of protists: In the introduction, Maggi explained the new term "protistology", though he pointed towards predecessors of the concept, including Bory Saint-Vincent's *psychodiaires*. He then discussed Haeckel's Protist Kingdom and Wyville Thomson' criticism of singling out these organisms,[203] to which Maggi answered with his own observations. After explaining the utility of medical protistology, Maggi dealt with "the fundamental question regarding the origin of protists – direct observations and experimental research on its behalf – contributions by professors from the University of Pavia".[204] He therefore must have introduced his students to the works we have discussed extensively in the previous chapter, which is to say, heterogenesis, though he does not yet use the term at this point in the course outline, as he does not use it in his much later published summary of the Pavia group's heterogeny research in 1884 (M143). There appears to be a pattern emerging, whereby Maggi avoids the use of a discredited label, while continuing to affirm the content of his belief in the actual origin of plastidules and single-cell protists from organic matter.

The course itself, after the introduction, was divided into a "general" and a "special" part. The first part outlined Haeckel's taxonomy of protists, including the *fungi*, presenting examples on wall charts[205] and by demonstration through the microscope. Their physiology was discussed under the aspects of *trophology*, *tocology*, *ecology*, and *chorology*,[206] the latter two developed in Haeckel's *Generelle Morphologie* of 1866 – Maggi comprehensively introduced his students to a work which has never

201 Maggi records the enrolment of 62 participants in the first year (M95:9)

202 The inaugural lecture of his first elective course, *eterogenia sperimentale*, was published in the *Gazzetta medica* in 1872 (M34). The further development of his teaching is discussed in M162.

203 The printed text has "Wylle Thomsons" (p. 79); generally, though, the printing of the *Bollettino* is relatively accurate.

204 "Sua [sic; must be: Sulla] questione fondamentale risguardante l'origine dei Protisti. – Osservazioni dirette e ricerche sperimentali in proposito. – Contribuzione datavi dai Professori dell'Università di Pavia" (M90:79).

205 Some of the surviving wall charts have been reproduced in Rovati & Violani (eds., 2005).

206 Roughly, nutrition, reproduction, interaction with the environment, geographical distribution.

been translated into any other languages, while the popular version, *Natürliche Schöpfungsgeschichte*, was not available in Italian until the publication of Daniele Rosa's translation in 1891.[207] At this point, it should be noted that the presence of Haeckel is far more prominent in Maggi's teaching than it is in his research articles, which accounts for the judgement of his eulogisers that he always professed the "Haeckelian gospel", while his particular studies are presented in a rather more factual manner, even though Haeckel's doctrine of recapitulation is ever present implicitly.

In the second part of his course, Maggi focused on medically relevant protists, beginning with the monera in general, their different sub-groups and their respective pathogenic properties. In this section, actually, the professor did refer to concepts of protist origins, discussing panspermia and heterogeny, and distinguishing autogeny and plasmogony. It is rather unfortunate that this simple list of headings is all we know about his course, set up right at the moment of the "eclipse of spontaneous generation". From that list, in any case, it appears that monera and their origins and transformations made up the main part of these lectures, while the higher protists are mentioned very briefly at the end, and the fungi are left out altogether in this section, referring students to the university's laboratory of cryptogams directed by the botanist Santo Garovaglio.

Maggi's publications during the first year of his teaching in medical protistology cover an unusually varied range of topics: Only two of them deal with protists, namely, a parasite living on the gills of crayfish (M88, M89), while others are discussing basic concepts in morphology and teratology.[208] Maggi's brief note with the simple title "Morphology" (M94) opens the first issue of the new *Bollettino scientifico* the comparative anatomist launched that year, jointly with the pathologist Achille De Giovanni and the human anatomist Giovanni Zoja. We can safely assume that Maggi, having organised the meeting of the *Società italiana di scienze naturali* in Varese the year before, was deeply absorbed in administrative and teaching matters, setting up the course in medical protistology and the *Bollettino*, while even one of his co-editors, De Giovanni, was actually in the process of moving from Pavia to Padua, where he had just been appointed professor of clinical medicine. Throughout the twenty-one volumes of the *Bollettino*'s existence, the majority of short notes and reviews are signed "M.", suggesting that, indeed, Maggi was shouldering the bigger part of its operation most of the time.

Much as it is chronologically convenient to analyse Maggi's protistological freshwater studies in a chapter on medical protistology, this is another of the

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207 *Storia della creazione naturale*. Turin: UTET. The first instalments were published in 1890.

208 M91, on the origin of organs, and M92, on "arithmetic hemiteriae", a concept introduced by Isidore Geoffroy Saint-Hilaire to describe "numeric semi-monstrosities", i.e., less severe malformations or variations in the number of bodily organs. In the specific case, the anomaly in the number of vertebrae is manifested in the absence of a tail in a calf Maggi had been given for the museum.

choices that can only be justified retrospectively: The testing of drinking water reservoirs was to become a crucial issue for Maggi over the course of the 1880s, but was clearly not on his mind when he first embarked on the project to survey the microbial fauna of the Alpine lakes in 1880. In his first note on the subject (M106), Maggi demonstrates that almost all groups of protists, except for strictly marine or parasitic ones, can be found in the lakes of Lombardy and Piedmont, where he had either collected samples himself or received them from colleagues. The note begins with a remark saying that the communication would be short – it is not quite. As the author confesses at the end, in one of his rare "lyrical" moments, he entered into a debate which he originally had not intended to touch and was now not going to solve: "I let my mind roam, but since I had a pen in hand, I wrote what I thought".[209] This debate concerns the origin of the Alpine limnofauna, which had been discussed by his colleague in zoology, Pietro Pavesi, the year before. Here we suddenly see Maggi's past experience as a geologist re-emerge: Pavesi contemplated the role of the lakes' geological history for the formation of their fauna. Antonio Stoppani had hypothesised that the great lakes had been maritime fjords before the emerging landmass isolated them from the sea. Maggi, on the other hand, was more inclined towards an explanation for the deposits in these lakes as results of glaciation and glacier lakes, which he himself had described in 1869 (M15), following observations made by Charpentier a generation earlier. Without further geological studies, Maggi concludes, the question of the "phylogeny of glaciers" cannot be solved, and knowledge of the latter, he adds, is indispensable for the study of the phylogeny of the extant aquatic organisms.[210]

The connection between Maggi's systematic interest in freshwater protists and hygiene of drinking water was made explicit in the following year, in the opening lecture of the course on medical protistology (M112). Traditionally, he complains, the potability of water from any source has only been tested by physico-chemical means, while the "thousands and millions of protists" contained in every cup of water escaped from scrutiny, although some of these organisms were very much able to cause severe diseases: "Diarrhoea, dysentery, typhoid, tropical relapsing fever, and goitre [sic] are diseases considered to be caused by micro-organisms, which sometimes live in drinking water".[211] Goitre, a marked hypertrophy of the thyroid, was particularly prevalent in the Alpine valleys. It often went along with "cretinism", a syndrome characterised by physical and mental retardation. A connection between this condition and the quality of the water consumed by

209 "Ho lasciato vagare la mente, ma avendo la penna in mano ho scritto quello che ho pensato." Signed Cuvio, 24 July, 1880 (M106:43).

210 "La filogenesi dei ghiacciaj, in questo caso, deve contribuire alla conoscenza della filogenesi degli attuali esseri organizzati acquatici." (M106:43).

211 "E la diarrea, la dissenteria, la febbre tifoidea, la febbre ricorrente dei tropici ed il gozzo sono malattie ritenute prodotte da microrganismi, viventi talora nelle acque potabili;" (M112:80). In the context it is not always clear if Maggi is referring to the goitre or to cretinism.

those affected had long been suspected, "since the times of Hippocrates", as Maggi reminds us (ibid.:81). While initially the chemical composition of the water had been considered responsible for the development of cretinism, Klebs in 1877 claimed to offer proof for the microbial origin of goitre.[212] Maggi warned his students that, only days before he delivered his lecture, the city of Milan had decided to exploit a new source of water for the use of its citizens, which came from a spring suspected of carrying the agents assumed to cause goitre. As a positive example, Maggi then described a new project to channel water from the Lago Maggiore to Milan, where he had been commissioned to perform a protistological test on samples collected at the prospective site of the new aqueduct. He found the water to be of satisfactory quality (M124), after examining the samples applying state-of-the-art staining techniques, largely those developed by Adolphe-Adrien Certes in Paris, a procedure which a month later he described in more detail at the *Istituto Lombardo* (M113).[213]

Techniques for protistological examinations became increasingly central for Maggi during the years of his commitment to water hygiene, culminating in the compilation of a dedicated manual on *Tecnica protistologica* published in 1895 (M217), which served as a companion to his earlier *Hoepli* manual on protistology, of which the second edition had just come out in 1893 (M206). The technical manual provides a comprehensive review of staining and other techniques developed internationally and up to the date of Maggi's writing. On the other hand, it is quite striking to see that Maggi, in a chapter devoted to the "production of protists" (pp. 65-83), returns to the "artificial infusions" which the Pavia group had been experimenting with in their study of spontaneous generation. Even though he points out that the intentions of the earlier experiments had been different from those pursued in the manual,[214] the contradiction remains: On the following pages, Maggi talks about the decomposition of the dead organic matter as a crucial precondition for the formation of microbes – even though he again avoids the use of the term "generation", implicitly he must still assume heterogenesis to happen in his "artificial infusions", when he describes the types of protists originating from different forms of boiled organic matter, and the role of the heat in decomposing the substrate producing protists.

The closest that he actually gets to giving up on heterogenesis is in a somewhat exasperated remark in his opening lecture to the medical protistology course in 1887, where he introduces his students to theories of the internal generation of

212 Maggi discussed Klebs' results (1877) in more detail in the *Gazzetta medica* the following year (M123). This note, which contains several passages already mentioned in M112, was added to the Hoepli manual *Protistologia* (M121) in the appendix (pp. 167-183), but omitted from the second edition published in 1893 (M206).

213 Maggi's reference is to a memoir by Certes published in the *Comptes Rendus* of the Paris Academy of Science in 1880; see also Certes (1883).

214 "though, in our case, with different intentions" ("benché, anche da noi, con intenti diversi") (M217:65)..

pathogenic micro-parasites, which had been discussed since mid-century, but received a new lease of life through recent observations by a French oenologist, Chavée-Leroy. As Maggi complains:

> *Nobody [sic] so far has thought of this micro-parasitical formation, certainly because of the red herring [lit.: scarecrow] which is spontaneous generation, without considering that this is not a case of primary origin, but simply a morphological regression …*[215]

In line with his plastidular theory, Maggi argues that living organisms under ordinary circumstances undergo a morphological progression, with plastidules joining to form plastids to form cells etc. In pathological conditions, this process reverts, setting free the simpler components, some of which can then become pathogenic themselves. This model, clearly, does not require the assumption of life originating from organic matter that is already dead, nor does it exclude spontaneous generation; but Maggi apparently is not prepared to go any further down that road, which would take him away from the cherished idea of a unity of the world beyond the divide between the living and the dead.

Undeterred, Maggi continued to investigate the medical and veterinary importance of protists. Whenever unknown diseases were reported to decimate livestock, Maggi would dissect and examine the carcasses, searching for potential microbial causes of their demise, be they unidentified anaerobic bacteria in trout (M130), or experiments with anthrax vaccination in cattle, following Pasteur's recent successes (M131), which had been severely challenged by members of the Turin Academy of Science.[216] In the field of human pathology, Maggi examined the work which the late Filippo Pacini (1812-1883) had done on the presumed agents of cholera, reinterpreting his findings in the light of the new protist taxonomy (M145, M148, M149). His main concern during the 1880s, however, remained the issue of drinking water hygiene, and his expertise was recognised in 1887, when he was commissioned to write a large contribution to a volume on drinking water published in a series of handbooks on foodstuff deterioration, which was awarded a silver medal at the Twelfth Medical Congress in Pavia.[217] Though three-quarters of the volume were still reserved for chemical analyses proposed by his co-author, Pavia pharmacologist Paolo Emilio Alessandri, Maggi contributed over a hundred pages on the *esame microscopico* (M166). But not only had the Congress organisers been impressed by Maggi's (and, of course, Alessandri's) work, the appreciation was clearly mutual. Maggi was delighted by the lectures he attended, which to him indicated that "the physicians want to become naturalists in the strict sense of the word."

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215 "Nessuno finora ha pensato a questa formazione microparassitaria, certamente, per lo spauracchio della generazione spontanea, non riflettendo che qui non si tratta di origine primitiva…" (M171:20).

216 [Vallada] (1883); see Debré (1994): 434f.

217 Notice in *Boll. sc.* 9 (1887):94.

In many lectures, protistology and morphology dominated; of which I was most content, as these are the two disciplines which for a decade I have worked to develop at our university, both with my elective and compulsory lectures, and with the work done in the laboratory under my direction.[218]

In a more popular vein, Maggi also dealt with the positive role played by a number of protists, "little benefactors of humanity", which he presented to a wider audience at the "Philological Circle" in Milan in the spring of 1886 (Fig. 7),[219] while later that year, he opened his medical protistology course with a lecture on the importance of certain alkaloids produced by protists.[220] Apart from these good-humoured addresses, it appears that the general outline of his teaching remained closely geared towards a systematic, taxonomic approach, with greater emphasis on (Haeckelian) classification and comparably little room for more strictly clinical applications. Out of the forty sections listed in the published outline of the course, only a handful mention pathological processes, while the majority present the general natural history of protists, including their origin and Maggi's plastidular theory, which he had first promulgated in 1875.[221]

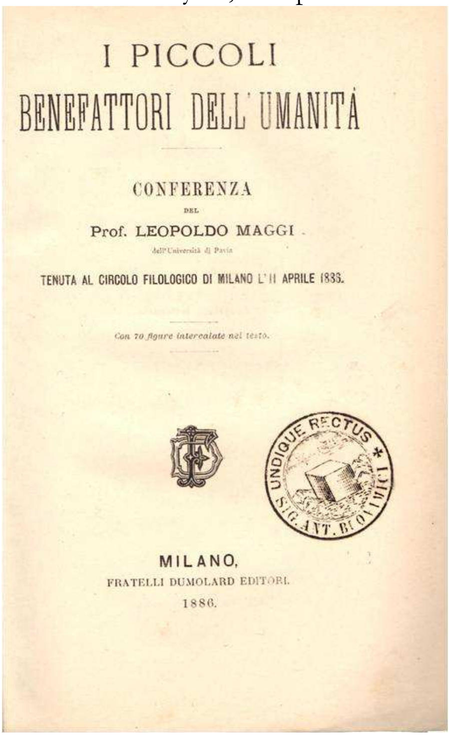

I PICCOLI
BENEFATTORI DELL'UMANITÀ
CONFERENZA
DEL
Prof. LEOPOLDO MAGGI
dell'Università di Pavia
TENUTA AL CIRCOLO FILOLOGICO DI MILANO L'11 APRILE 1886.
Con 70 figure intercalate nel testo.
MILANO,
FRATELLI DUMOLARD EDITORI.
1886.

Fig. 7: M 160

[218] "… i medici vogliono diventar naturalisti nello stretto senso della parola […] In molte letture poi, dominava la protistologia e la morfologia; e di ciò me ne compiacqui perché queste due scienze sono appunto quelle che da un decennio io vado facendo sviluppare in questa Università, sia colle mie lezioni libere ed ufficiali, sia coi lavori che si fanno nel Laboratorio da me diretto." Maggi (1887): 'XII Congresso Medico tenutosi in Pavia nello scorso settembre'. *Boll. sc.* **9**:95.

[219] M160; on the history and role of the *Circolo filologico di Milano*, founded in 1872 by former *Risorgimento* activists with the aim to improve popular education, see Cappelletti (1972).

[220] M160; the summary included in the *Boll. sc.* 8 (1886:111f.) is missing in Maggi's bibliography M272.

[221] M51, see last chapter.

The origin of vertebrate skulls

> In your opinion, are my works in craniogeny satisfactory? They have been made in the wake of the law which you have called the fundamental biogenetic [law]. For now, I am developing the specific arguments, and if those will meet with the anatomists' approval, I will treat the morphology of the skull comprehensively. There is no lack of material, as I have fetuses, several I may say, for each order of mammals, in addition to the various classes of vertebrates.[222]

By the time of writing this letter, Maggi had spent a full ten years "developing arguments" in craniogeny. On the one hand, his reference to the biogenetic law is perfectly plausible, and in this chapter, we will follow some of his "specific arguments" – and yet, the puzzlement about his abrupt change of research area in

222 Maggi in a letter to Ernst Haeckel, dated 18 June 1899, see appendix for the complete text.

1889/1890 remains, even after detailed reading of his publications and later lecture notes, his few surviving letters, and testimonials from his contemporaries, colleagues and students, who tend to list the different areas of Maggi's research career without commenting on possible connections. Even his disciple Giacomo Cattaneo, the one among his students whose interests were the closest to their master's, betrays a certain helplessness in the face of some seventy papers, some of them very substantial, presenting a vast amount of detailed information, "disjointed, or united in groups of arguments", but interesting for the "sometimes bold rapprochement between embryonic dispositions in mammals and adult forms of ganoids or fossil reptiles".[223] Fabio Frassetto from Bologna, by contrast, even defined a "Maggi school of anthropology", though he lamented that Maggi's early death had left the development of his work incomplete:

> *He left us when he was just getting ready to bring together the numerous extensive researches in craniogeny […] The new approach which he applied to the study of the skull allowed anthropology to enter a new phase of great importance, because by following the development of individual bones in the all the craniates and in all ontogenetic phases – as he pointed out – one can establish the modifications in time and space, thus contributing to resolving the problem of the origin of Man.*[224]

How then did Maggi go about the leap from plastidules to humans? It is true that, early in his career, he had been studying human skulls in a palaeoethnographic context, describing specimens recovered during local excavations in the area of Varese. In addition, his geological work of the late 1860s on glacial deposits in the Alps had provided the opportunity to discuss the presumed age of human remains, artefacts, and other traces of human activity, which had been discovered in a variety of places, within and beyond the confines of the Italian peninsula (M22). Those were not, however, specifically comparative or even evolutionary

223 "Pur così staccati, o riuniti a gruppi di argomenti, sono però sempre contribuzioni interessanti, anche per i ravvicinamenti talvolta arditi che il Maggi propone fra disposizioni embrionali di mammiferi e forme adulte di ganoidi o di rettili fossili" (Cattaneo 1905:81). The ganoids roughly correspond to *chondrostei*, cartilaginous fish with some osseous elements in their skeleton, like the sturgeons. At the time, they were considered a link between cartilaginous fish (*chondrichthyes*) and bony fish (*osteichthyes*), hence Maggi's particular phylogenetic interest.

224 "Ci mancò proprio quando già si disponeva a raccogliere le numerose ed estese ricerche di craniogenia […] Il nuovo indirizzo che egli diede allo studio del cranio fece entrare l'antropologia in una nuova fase di grande importanza perché, seguendo lo sviluppo delle singole ossa del cranio in tutti i craniati e in tutte le fasi ontogenetiche – come egli indicò – si giunge a stabilire le modificazioni avvenute nel tempo e nello spazio, contribuendo in tal maniera a risolvere il problema dell'origine dell'uomo" (Frassetto 1905:321). Frassetto had been a student of Lorenzo Camerano and Cesare Lombroso in Turin, before moving to Bologna in 1904; see Benassi Graffi (1957), Cappieri (1955:490) with a notice of his death, and some brief information in Chiarelli (2003:18).

studies.[225] Rather, Maggi measured and classified the finds according to the categories and indices established by Broca, Welcker, and Huxley, respectively (M77). As for the prehistoric skulls, Maggi sought to correlate them to those from "races" of the historic era, in order to confirm the greater age of the specimens, exchanging notes with the "illustrious ethnologist and archaeologist [Giustiniano] Nicolucci" (1819-1904), one of the first anthropologists in Italy. We may already make a mental note of the fact that Maggi refers to Nicolucci as *illustre etnologo e archeologo*, rather than *antropologo*, and that Maggi does not seek advice from his former senior colleague, now professor of anthropology, Paolo Mantegazza (who had won his chair in Florence, five years earlier, in competition with Nicolucci).[226] But, after Maggi's move from geology into zoology (1874) and comparative anatomy and physiology (1875), human skulls disappeared from sight for another fifteen years.[227] Most of his work in the 1870s and 80s, as we have seen, focused on protists, their production and reproduction, and their role in public health. There were a few "occasional" papers dealing with vertebrates and other higher animals, often in relation to specimens obtained for the museum of comparative anatomy and physiology, the directorship of which was part of his position. He showed a very serious commitment to the expansion of the museum collections, with a measurable emphasis on the skeletal system: from the original catalogues, it has been calculated that the proportion of "bony material" increased under his directorship from nineteen to thirty percent.[228] As early as 1879, he managed to obtain, through the Ghislieri College, the skeleton of a Gorilla, quite a rare specimen at the time, whose significance for the Pavia museum he described in an article for a local newspaper (M93). But even this growth of the osteological collection can more plausibly seen as a result of the director's interest, rather than a motive for his later change of research area, especially since he already acknowledged the richness of the Pavia collections of human skulls in a paper in 1878 (M77:311), over a decade before his first comparative anatomical work on *crania*. In other occasional notes, he dealt with morphological anomalies, observed both in invertebrates and vertebrates. But there do not appear to be any specific circumstances to account for a profound rupture in the baseline of Maggi's work. It is true, though, that his colleague in human anatomy, Giovanni Zoja, whose institute held the human skull collection which had been so useful to Maggi in 1878, increased the number of his publication in this particular field around 1888, as the statistics worked out by Porro (2001:49) demonstrate. Given Maggi's lifelong focus on the local research environment, this observation might be of

[225] though in other instances, anomalies found (or not…), say, in ancient Egyptian relics, human or animal, had played an important role in debates about the fixity of species maintained, e.g., by Georges Cuvier, in the first third of the century; see Rudwick (1997: 228f.).

[226] M49, instalment 9 Aug. 1874, no. 28 p. 3. On the relation between Nicolucci and Mantegazza, see Landucci (1988).

[227] With the exception of two notes read at the naturalist congress in Varese, 1878 (M77, M80).

[228] Barbagli & Rovati (2002):71.

some relevance. In the main, however, Zoja's approach was craniometric, measuring and classifying skulls, although he did produce some work in morphology, some of which was later cited in Spee's section on the cranial skeleton in Karl von Bardeleben's eight-volume handbook of human anatomy (Spee 1896). Therefore, although Maggi does accord Zoja the title of a "distinguished craniologist", there does not seem to be much of a direct connection between the two colleagues' and friends' craniological researches.[229]

Maggi began to make his studies public in September 1889, when he read a "preliminary note" to the audience of the congress of the Italian Medical Society in Padua, entitled "two craniological facts in some mammals" (M187). This is how the first paragraph reads in the Italian publication:

> *The first of the two craniological facts which I found in some mammals refers to the closing of the sutures and precisely at the time in which this occurs with respect to the two tables of the cranium.*[230]

There is hardly a more laconic way of launching a new field of investigation; to call this an understatement would be an understatement in itself. Yet the talk seems to have been of some importance to the author: Not only was it published in the transactions of the congress[231] and in the *Bollettino* in Pavia, but it also appeared in the French-language *Archives italiennes de Biologie*, founded in 1882 by the physiologist Angelo Mosso (1846-1910) in Turin. Multiple publications were of course not unusual at a time when circulation of journals and books was still limited, and the *Archives* were specifically set up to make Italian publications known to an international readership; Maggi had already contributed a paper the year before, on protozoans.[232] Still, one would not assume that he considered these *deux faits craniologiques* as a minor, occasional note, like the previous communications on abnormal facts found in higher animals.

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229 "si fece distinto craniologo" (M258:129). G. Zoja is still remembered for describing the skulls of illustrious personalities of Lombardy's recent and distant past, such as his predecessors', Antonio Scarpa (1752-1832), Bartolomeo Panizza (1785-1867), naturalist Balsamo Crivelli (1800-1874), but also pre-Renaissance nobility from Milan, Gian Galeazzo Visconti (1351-1402) and his wife, Isabella de Valois (1348-1372), ibid. & Porro (2001):55.

230 "Il primo dei due fatti craniologici che trovai in alcuni *mammiferi* si riferisce alla *chiusura delle suture* e precisamente *al tempo* in cui essa avviene rispetto alle due tavole craniche" (M187:97). The bones of the skullcap consist of three layers: two compact tables (or *laminae*) on the inner and outer surfaces, and a spongy layer in between (*diploe*).

231 which I have not been able to consult; the reference is by Maggi in *Boll. sc.* 11 (1889):122.

232 M179, translation of M175.

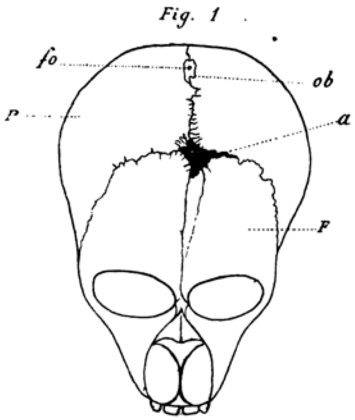


Fig. 8: Skull of juvenile gorilla M190 from plate 5

The pattern of fusion which Maggi presented, however, was not abnormal in his view; rather, he challenged the accepted rule for the obliteration of sutures, which postulated that, when the membrane bones of the skull cap fuse in adult life "the sutures first disappear on the inside of the skull and then on the outside".[233] After a brief review of exceptions published by Cuvier, Meckel, Serres, and a few others, who had not commented on the assumed general rule, Maggi proceeds to present some cases which he and his colleague in human anatomy, [Giovanni] Zoja, had observed, where either the interior lamina was fused first, or both layers contemporaneously. Maggi proposes to embark on a large survey of cranial specimens from various museums, in order to be able to compare data across all orders of mammals, beyond his own Museum and the public museum in Pavia, directed by his zoologist successor, Pietro Pavesi. During his research, Maggi had noted another fact, the persistence of a suture in the occipital bone of a lion, demarcating the interparietal bone, which in lions, even in the fetal stage, should not be identifiable, according to a note by Eugenio Ficalbi (1858-1922). This second fact, then, did represent an anomaly, while it was not so uncommon in human specimens, especially prevalent among populations in South America (hence, known as "Inca bone", *os incae*). Now, these "supernumerary bones" were to occupy Maggi for the rest of his life (and will occupy us for the rest of this chapter). Why was he, and why should we be so thrilled by these findings? The published note does not tell, being as dry as it is. And this extreme matter-of-factness, remarkably different from the work on protists and plastidules, characterises his entire published *œuvre* in craniology, to the extent that most distinguished colleagues (and notably Paolo Mantegazza in Florence) will find it hard to warm themselves to Maggi's enthusiasm. We of course enjoy the benefit of glimpsing through his private letters to Ernst Haeckel, which do provide a rationale, formulated after a whole decade of "bone counting". Still, it does not seem likely that we will ever find a satisfactory explanation for the timing of Maggi's new research interest.

It has become a commonplace notion to acknowledge that we see what we expect to see, and we interpret what we see in the light of preconceived ideas and expectations. This is true of cell theory, reviewed by Andrew Mendelsohn in an entertaining conversation about 'Lives of the Cell' (2003), but the same

233 "…che le suture scompaiano dapprima all'interno del cranio e poi all'esterno" (M187:97f.).

observation can be made with respect to the morphology of vertebrate skulls. The occurrence of supernumerary, suture or intercalated bones had been noted, and not for the first time, in the seventeenth century by the Danish naturalist Ole Worm (1588-1654).[234] Many of the innumerable skulls kept in collections around the world exhibited instances of these features, and a considerable number of published descriptions displayed additional cranial bones. But prior to the establishment of the biogenetic law, no conceptual questions were raised by the presence of sometimes hundreds of additional pieces of bones identifiable in skullcaps of mammals, including humans. There simply did not seem to be much reason to study such erratic anomalies systematically, especially since they usually did not cause any functional impairment, except in a few cases when premature ossification of the cranial sutures restricted the growth of the enclosed brain. However, most of the skulls which contained supernumerary bones had reached their expected size and shape – it just so happened that there were some or many ossicles identifiable between the main components of the skullcap, or one or more of the major bones was made up of several elements which failed to fuse completely in fetal or adult life. Observations in this field were recorded aplenty throughout the nineteenth century. In 1900, the German anthropologist Johannes Ranke (1836-1916) produced a lengthy memoir on the subject, published by the Bavarian Academy of Science. He surveyed a wide range of literature, including researches by the anatomist Luigi Calori from Bologna, who in 1867 had published a paper "on supernumerary sutures of the human skull, and in particular of the parietal bones", a topic of particular interest to Ranke, who quoted the treatise, admitting that it had not been accessible to him.[235] Maggi's works, however, are not mentioned in Ranke's memoir, as the anatomist from Pavia promptly complained, 'despite the fact that the Lombard Institute's publications were exchanged with the Bavarian Academy's'.[236] On closer inspection, it appears that Ranke's knowledge of Italian anatomical works was mainly based on a lengthy memoir by Hermann Stieda (1892),[237] which covered literature up to 1891, including the *Archivio per l'antropologia e la etnologia*, where Maggi had indeed published one paper in that year (M194), but not on the issue studied by Stieda

234 In 1898, Maggi actually came to reject the term "supernumerary bones" (which, after Worm, are sometimes called "Wormian bones"), as he did not consider them a secondary anomaly, but rather vestiges of the phylogenetically primitive situation, homologous to elements of the osteoderm of lower craniates, as we will see below (M248:1489). He later chose the more neutral term "suturo-fontanellar ossicles" (*ossicini suturo-fontanellari*), which left open their primitive or secondary character (M251).

235 Calori (1867), quoted in Ranke (1900:291 note 1). See Scarani & Ruggeri (2007): 97.

236 (M267:148 n.)

237 Hermann Stieda, in 1892 "assistant at the anatomical institute in Königsberg", presumably was a son of the then director of the institute, Christian Hermann Ludwig Stieda (1837-1918); Eisler (1919:24) mentions three sons of Ludwig's, all of them surgeons, one of whom died as early as 1896. Given names are not mentioned.

(and Ranke), the *Inca bones* (more particularly, the interparietal bones, which Maggi investigated for the first time in 1894). Hence, Maggi's allegation of wilful neglect levelled at Ranke appears to be unfounded, but his remark serves as a reminder of the peripheral position in which Maggi perceived himself and his Italian colleagues to operate, despite the international contacts forged, not least, through the bursary scheme set up by the Italian government to encourage students to travel abroad for their specialisation, as we have mentioned earlier (Dröscher 1992).

Ranke's own take on the phenomenon of supernumerary bones was far more sceptical regarding the interpretation of his findings as evidence for human descent from lower vertebrates. Whereas in his somewhat peculiar reading of evolutionary theory, "progress from simpler to more complex situations seems evident", he regarded the simpler composition of the human skull as the highest form of development, "though individual ontogeny and individual variation in the postembryonic structure are manifestations of the original complicated law of formation".[238] His response, as Geus (1987) argues, was not generally directed against the theory of evolution; rather, he objected to what he thought to be excessive speculation expressed in Haeckel's phylogenetic trees and the political implementation of presumed scientific facts, especially in the field of anthropology, which in Germany at the turn of the twentieth century had of course already assumed a position of racial distinction and ranking,[239] an attitude which, as we have seen above, at least Maggi would have had very little interest in.

Following his first work on the obliteration of cranial sutures, Maggi proceeded with two notes on the fontanels in some mammal species (M190, M191). He began by describing the process of ossification extending from individual centres, which expand across the membranous enclosure of the brain, until, at birth, the skull is mostly covered with bone, leaving small portions of membranes, known as fontanels. Didactically, these articles are a far cry from the previous "preliminary note". Maggi embarks on a painstaking survey of the sutures between the individual bones forming the roof of the skull (the "*calvaria*") and the fontanels occurring regularly or exceptionally between them in different species, scarcely reported in the existing anatomical literature, as he complains (M190:442). While information on human and anthropoid fontanels was still

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238 "Während nach diesen [theories of evolution] ein Fortschritt von einfacheren Verhältnissen zu komplizierten selbstverständlich erscheint…" "Aber individuelle Entwicklungsgeschichte und individuelle Variation des Baues im nachembryonalen Leben lassen das primäre komplizierte Baugesetz auch bei den reduzierten Formen noch hervortreten" (quoted in Geus 1987:16f.).

239 For the last thirty years of his life, Ranke argued against forays of science into the realms of politics, philosophy, and religion, *Übergriffe von dem Boden der Naturbeobachtung auf jenen der Politik, Philosophie und Religion* (*Der Mensch, 1887*, preface; quoted from Geus 1987:15), and in his posthumous review (1917) of Friedrich Hertz' *Rasse und Kultur* ([2]1915), in the middle of World War I, Ranke protested against the "scientific" pretext of instinctive racial hatred (*angeblich instinktive[r] Rassenhaß*) proposed by his colleagues as an explanation of the war (quoted from Geus 1987:14).

relatively abundant, other species had been hardly covered, and Maggi set out to perform his own researches, initially with pig fetus skulls acquired from the Pavia abattoir (M190:453-460), followed by sheep and cattle, diligently measuring and drawing the situation at various stages of gestation and early postnatal life (M191). He then went on to examine the base of the skull, which in embryonic development is preformed by cartilage, and only subsequently ossifies. At the point where in early development the so-called "pouch of Rathke" gives rise to part of the pituitary gland at the base of the brain, a canal crosses the supporting bone (*sphenoid*), which in most mammal species later obliterates, though in some, it persists regularly, and in others (among which, *Homo sapiens*), it may persist under abnormal circumstances. In his first note on the subject (M192), Maggi studied the cranio-pharyngeal canal in rodents, and in his second article (M194) in the anthropoids, using not only collections held in Pavia, but also specimens provided by Giacomo Doria (1840-1913), founding director of the civic museum of natural history in Genoa, and by Maggi's former student and assistant Corrado Parona, at the time professor of zoology and director of the zoological museum at the university of Genoa.[240] While examining these skulls, Maggi went on establishing other anomalies, which he recorded with his habitual care (M196), collecting evidence for what he called the "law of organ compensation" and the "law of organ fusion" (rather than complete obliteration of parts).[241] The persistence of presumed ancestral traits ("atavism" in Cesare Lombroso's term) became increasingly the focus of Maggi's research, following Haeckel's dictum that ontogeny was a rapid recapitulation of phylogeny, and atavistic structures consequently could be seen as supporting phylogenetic trees. Thus, he concludes his note on the rodents with these words:

> *What I have laid out about the craniopharyngeal canal in the above mentioned rodents serves to validate my concept, which I have already expressed publicly, that in animals as in Man, observing a large number of individuals pertaining to the same species, one can encounter many diverse anatomical variations, which, more than just in anthropogeny, concur as documents for the phylogeny of all animals, and, in our particular case, of all mammals.*[242]

[240] That same year, Giacomo Cattaneo was appointed to a professorship for Comparative anatomy and physiology in Genoa, with the same remit as Maggi's (*Bollettino scientifico* 12, 1890:64), contributing to the strong links between the coastal city and Maggi's inland domicile.

[241] "*la legge di compensazione degli organi*", and "*la legge di fusione degli organi*" (M196:414).

[242] "Quanto ho esposto intorno al canale cranio-faringeo nei suaccennati rosicanti, vale a confermare il mio concetto, già pubblicamente espresso, e cioè che negli animali, come nell'uomo, osservando un gran numero di individui appartenenti alla medesima specie, si possono incontrare molte e diverse varietà anatomiche, le quali più che per la sola antropogenia, concorrono come documenti per la filogenia di tutti gli animali, e, nel nostro caso particolare, di tutti i mammiferi" (M192:727).

These ambitious phrases were reproduced in the anonymous review of Maggi's paper in the *Bollettino scientifico* (12, 1890:149), which we may well ascribe to the same author, who had his craniological contributions to the *Rendiconti* extensively covered in the *Bollettino*. It was unfortunate for the reception of Maggi's approach that the last sentence (with references to anthropogeny and phylogeny) was missing in the anthropoid paper, and this was Maggi's only article to be included in the *Archive of Anthropology*, hence he withheld his interpretation from the anthropological audience.[243]

Other irregularities discovered in the course of Maggi's survey among the anthropoid apes include the maxillary and nasal region, with impacts on dentition (M197), identification of alternative versus derivative forms by application of Haeckel's biogenetic law (M198),[244] and the various degrees of fusion of bones developing individually in the fetus (M199). On the latter phenomenon, already in 1885 Maggi had published a discussion at a general level, "On the morphological distinction of organs in animals" (M150), where he introduced the term "synchysis" for the fusion of elements in the formation of organs or organisms in the line of descent, resulting in "synchyte" organs, such as syncytia (e.g., slime moulds), or the central bodies of the vertebrae.[245] Consequently, in his study of anthropoid apes, Maggi terms "asynchyte" those bones of the upper jaw which exceptionally maintain their primordial separate existence in the adult (*mesognati asinchiti*).

In his further research on variations of the occipital bone, which produce these "interparietal" bones, Maggi made extensive references to earlier studies published by Johann Friedrich Meckel (1781-1833), who in 1812 implicitly formulated a biogenetic law, though of course not with a view to actual genealogical descent.[246] Accordingly, he attempted to explain at least some of the

243 The passage in M194 reads: "Yet also the above statistics result in a reconfirmation of my concept regarding the many and diverse anatomical varieties to be found in animals, as in Man, observing a great number of individuals pertaining to the same species" ("*Tuttavia anche dalla statistica suesposta consegue una nuova conferma del mio concetto intorno alle molte e diverse varietà anatomiche che si possono incontrare negli animali, così come nell'uomo, osservando un gran numero di individui appartenenti alla medesima specie*"); *Archivio* p. 56/*Rendiconti* p. 141.

244 "There are more or less manifest rudimentary parts [in the ossa nasalia in Orang-utan] which in the ontogeny record the phylogenetic conditions and hence the primordial form to be the broad [variety of] the nasal bones." ("Tuttavia in questi esistono delle parti rudimentali più o meno manifeste, che ricordano nell'ontogenesi le condizioni filogenetiche e quindi la forma primordiale di ossa nasali larghe"); M198:819.

245 As he explains, the terms derive from the Greek σύγχυσις "fusion, mixture", and σύγχυτος "fused, mixed" (M150:488).

246 "if there is a way to arrive at laws of formation and to gain insight in the functions of organisms, it surely leads through comparison of that organism: 1. with itself in different periods of its existence and regarding its different organs in the same period; 2. with other organisms; 3. comparison of the functions of organisms with the function of other general powers, which ensoul also the inorganic nature and which are better known and easier to study." ("*gibt es einen Weg zu Bildungsgesetzen zu gelangen und Aufschluss über die Wirkungsweise der Organismen zu bekommen,*

observed "malformations" as persisting features of lower organisms which would normally only mark a transitory stage of fetal development in higher organisms. (M213). In particular, Maggi identified four primary centres of ossification for the occipital bone in humans, which would normally create a single, homogenous occipital bone, but these four centres corresponded to regularly separate bones found in Stegocephalia, an extinct group of amphibians from the Carboniferous, Permian, and Triassic eras (M224:729). In some extant fish species, such as the bichirs (*Polypterus*), these centres are represented by four bony plates of the so-called "supraoccipital osseous shield", which in sturgeons was only to be found in very young individuals (M225:898f.).

In the year 1897, Maggi embarked on a broad survey of potential homologies to be established between the supernumerary bones he had been observing in current mammal species and their phylogenetic origin in the osteoderm[247] of fossil reptiles and amphibians. As he did not have access to significant collections of the fossils required for his comparisons, he made use of published descriptions made by palaeontologists, "through the work of valiant scientists", which meant that "one can be certain of the species identifications and of the representations of their skulls provided".[248] These researches led Maggi to formulate his own version of the biogenetic law: "ontocraniogeny repeats phylocraniogeny".[249] Subsequently, Maggi applied the biogenetic law in even more detail to individual bones of the skull: "*cranial onto-osteogeny* or the individual development of the skull bones *recapitulates cranial phylo-osteogeny* or the specific development of the skull bones".[250] Maggi's ideas of the mechanisms of ossification are reminiscent of his plastidular theory in protists. The following, quite remarkable description from 1897 does, however, stand relatively isolated in Maggi's craniological work:

> *In fact, the points or granules of ossification repeat the osteodermic granules of the sharks (**shark-type or selachian ossification**); the osseous trabecules, produced by the linear fusion of the osseous granules, repeat the structural conditions of the osteodermic plates of ganoids (**ganoid ossification**); the reticulum of osseous trabecules repeats the structural conditions of the osteodermic plates of the stegocephalia (**stegocephalic ossification**), and the compact state of the nuclei of ossification and of the bones*

so ist es wahrlich nur die Vergleichung desselben Organismus: 1. mit sich selbst in verschiedenen Perioden seiner Existenz und nach seinen verschiedenen Organen in derselben Periode; 2. mit anderen Organismen; 3. die Vergleichung der Wirkungsweise der Organismen mit der Wirkungsweise anderer allgemein verbreiteter Potenzen, welche auch die unorganische Natur beseelen, und deren Wesen bekannter und leichter erforschbar ist") (quoted in Ranke 1900:359, originally published in 1812 in Meckel's *Beiträge zur vergleichenden Anatomie* 2.2).

247 Bony plates or scales in the dermal layer of the skin.

248 "[…] per opera di valenti scienziati […] Si può dunque esser sicuri delle determinazioni specifiche e delle rappresentazioni ch'essi ci danno […]" (M230:230).

249 "l'ontocraniogenia, ripete la filocraniogenia (M237:88).

250 "*l'onto-osteogenia craniale* o sviluppo individuale delle ossa del cranio, *ripete la filo-osteogenia craniale* o sviluppo specifico delle ossa del cranio" (M248:1473).

> *themselves, belongs to the reptiles, among which are to be emphasised the gomphodonts, given that they are the organisms that could be named mammal-reptiles (**gomphodontic ossification**).*[251]

Without wanting to overstretch the analogy, it seems quite easy to see granular Vibrios form linear Leptothrices, reticulate Labyrinthulae, and compact Catallacts – a kind of recapitulation on a plastidular level, which Maggi does not spell out explicitly, but which would be very much in line with his overall conception of the biogenetic law, extending upwards to more highly differentiated organisms as well as down to the molecular level.

In most of his subsequent publications, however, Maggi presented himself far more modest, pursuing in a thorough, painstaking way the accumulation of very specific data, in line with the dictum of his Parisian colleague, the palaeontologist Jean Albert Gaudry (1827-1908), whom he quotes (M236):

> *Other palaeontologists will study the history of the evolution of [single] organs. One will choose this or that bone of the head, which one will follow from stage to stage; for example, one will see what phases the occipital, the frontal [bone], the nasal opening, the jawbones have gone through […] one will learn how, in the course of the ages, each organ has developed, bit by bit, from its first manifestation up to the moment where it has reached its maximum perfection.*[252]

Maggi continued on this path faithfully, examining in particular the interparietal, frontal (bregmatic),[253] and orbital region in ontogenetic (embryonic) and phylogenetic (paleontological) dimension. Thus, he demonstrated that the frontal fontanel and the parietal foramen in current mammals, including fetal and young postnatal humans, were homologous to two distinct openings in the skulls of

251 Infatti i *punti o granuli di ossificazione*, ripetono i granuli osseodermici degli squali **(ossificazione squaloidea o selaciana);** le *trabecole ossee*, date dalla riunione lineare dei granuli ossei, ripetono le condizioni di struttura delle placche osseodermiche dei ganoidi **(ossificazione ganoidea);** il *reticolo di trabecole ossee*, ripete le condizioni di struttura delle placche osteodermiche dei stegocefali **(ossificazione stegocefalica)**, e *lo stato compatto dei nuclei di ossificazione* e delle *ossa stesse*, è quello proprio dei rettili, fra cui vanno segnalati i gomfodonti, per essere degli organismi a cui si può dare il nome di mammalo-rettili **(ossificazione gomfodontica)**. (M237:88), emphases in the original.

252 "d'autres paléontologistes feront l'histoire de l'évolution des organes. On choisira tel ou tel os de la tête qu'on suivra d'étages en étages, par exemple on verra par quelles phases ont passé l'occipital, le frontal, l'ouverture nasale, les mâchoires […] on apprendra comment, pendant la suite des âges, chaque organe s'est peu à peu développé, depuis ses premières manifestations jusqu'au moment où il a atteint son maximum de perfectionnement" (Gaudry 1896, p. 51f.).

253 In cranial anatomy, the term "bregma" (Greek βρέχμα/βρέγμα: forehead) refers to the point where the frontal bone(s) and the parietal bones of the skullcap meet. In embryonic development, this is where the "great fontanel" is located, which in Italian is also called the bregmatic fontanel (*fontanella bregmatica*); RBr.

ichthyosaurs.[254] He concludes, once more, that "the comparative anatomy of fossils is an overt ontogeny of their successors, as the ontogeny of the latter [represents the] comparative anatomy of the fossils or their ancestors".[255] The cranio-pharyngeal canal, which Maggi had previously studied in extant vertebrates, had been observed by Cuvier in ichthyosaur skulls, though the French anatomist had not paid any particular attention to this structure (M245:761), but Maggi was able to demonstrate the homology by applying Geoffroy Saint-Hilaire's law of organic connections, that is to say, the correspondence between the position and relations relative to other organs, with the cautioning suggested by Henri Milne-Edwards that the organs have to be derived from a same fundamental type and of similar nature.[256]

Maggi's researches into the nature of suture bones in mammals also provided him with an opportunity to return to his very first craniological studies, those conducted on the prehistoric human remains discovered in the area of Varese in the early 1870s. Since those specimens actually did not display any traces of suture bones, Maggi undertook a broad survey of the palaeoanthropological literature, concluding that these widely described ossicles actually corresponded to the primeval configuration of the skull, with its original high number of centres of ossification, which during phylogenetic development can be obscured by fusion of the original centres or superseded by the formation of a new, encompassing "mammal ossification centre" (*centro di ossificazione mammale*). The reappearance of the primitive multiple centres, in Maggi's view, can be attributed not so much to atavism, as to "the quality of nutrition during and after gestation, and certainly to the insufficient supply of potassium salts for the further development of the mammalian ossification centre".[257] Quite in passing, Maggi mentions Louis Pierre Gratiolet's (1815-1865) distinction of "frontal, parietal, and occipital races" among humans according to the dominance of each one of the mammalian ossification centres of the skull (M251:384f.),[258] which Maggi had described previously (M235). This is one of the very few instances that he touches on the question of human races, which in any case did not fall into the remit of his research interest in comparative anatomy.

254 Maggi acknowledged that ichthyosaurs were not considered to be direct ancestors of humans, but he took the common situation of cranial anatomy to deduce that their common ancestors, pro-reptiles or proto-amniotes, would have displayed the same characteristics (M244:631).

255 "l'anatomia comparata dei fossili, è un'ontogenia aperta degli esseri a loro susseguenti, come l'ontogenia di questi esseri, è un'anatomia comparata dei fossili ed esseri a loro antecedenti" (M244:637).

256 "[la] corrispondenza nella posizione e nei rapporti relativi degli organi, e tenendo calcolo di quelle cautele suggerite da H. Milne-Edwards per la sua applicazione, e cioè che gli organi siano dei derivati di un medesimo tipo fondamentale ed affini tra loro" (M247:1089).

257 "dalla qualità della nutrizione durante ed anche dopo la gestione, e certamente da *insufficienza di Sali calcarei per l'ulteriore sviluppo del centro di ossificazione*" (M251:483).

258 Leuret & Gratiolet (1857):300.

Although we have seen that Maggi's research was performed in relative isolation from the anthropological community, in the last few years we can detect, through the references in his publications, the beginnings of a network of researchers, both in Italy and abroad, who are pursuing related interests. First of all, as we could expect from previous quotes, we have to mention Fabio Frassetto, whose works appear quite regularly in Maggi's memoirs.[259] But Maggi also refers to the anatomist Wenzel Gruber (1814-1890) from St. Petersburg, who had described "wormian" bones in a wide range of mammals, including primates, as had Fabio Frassetto, at the time still in Genoa, and Giovanni Canestrini's student Ugolino Ugolini (1856-1942) (M263:298f.). Finally, Maggi felt vindicated in his biogenetic approach by the anatomist Robert Wiedersheim (1848-1923), who in 1893 published an extended list of vestigial organs found in human anatomy, intended as an "index to his past history".[260] During the coming years, Maggi proceeded in a very systematic way, examining in great detail recent and fossil skulls available to him, as well as surveying the international literature on the subject of cranial morphology. The rhetoric of his presentation tends to be factual, understated, usually avoiding explicit speculations about overarching laws – with one or two exceptions, when he was somewhat more adventurous, as we have just seen (M237, M248). This is presumably why many of his readers at this stage were inclined to regard the author as an obsessive "bone counter". It was not until the foundation of the Italian Zoological Union (*Unione zoologica italiana*) in 1900 that he stated the "morphological significance" of these ossicles in the title of a communication (summarised in M266). Only careful reading of his work in its entirety actually provides some hints to his background assumptions. Obviously, in his letter to Haeckel he was perfectly frank and clear, as he could expect his "master", of all morphologists, to be sympathetic to his programme, which after all was aimed at providing evidence for the Jena zoologist's biogenetic law. In an article published shortly after the first congress of the *Unione zoologica*, Maggi did finally venture into a more philosophical approach to the explanation of cranial bones, required by unexpected difficulties in finding homologies between some additional ossifications in the chondral base of some anthropoid skulls and the osteodermic plates in ganoids: Albeit with reservations, Maggi revives earlier theories of the vertebral origin of the skull, popular especially in Romantic morphology.[261] This paper is another of the rare instances when Maggi let out some more of his clearly dearly held convictions in print. He accused his fellow anatomists of ignoring or forgetting available palaeo-osteological data, due to the

259 E.g., M256 (on supernumerary bones), M257 citing Frassetto's work on fronto-parietal bones.

260 Wiedersheim (1893), quoted in M265:691. This is an expanded version of a Wiedersheim's inaugural lecture in Freiburg, 1887, originally published in the *Berichte der naturforschenden Gesellschaft zu Freiburg* 2.4.

261 See e.g., Di Gregorio (1995); with regard to Maggi, see Landucci (1996a:2758). An important later elaborator of this concept was Richard Owen, whom Maggi does not fail to mention (M267:158). Concerning Owen's take on the vertebral theory of the skull, see Rupke (1993).

fact, he went on, that his colleagues "came from a decidedly medical-surgical school instead of that of the naturalists, which has a scientific culture of a wider natural history".[262] From this wider perspective, Maggi claimed that he could trace back the "missing" ossicles to spinal formations which Gaudry had observed in fossil amphibians and described in a monograph almost two decades earlier.[263]

Maggi's ambivalence towards epistemological assumptions was quite remarkable; on the other hand, it appears to mirror the conflict between positivism and monism, particularly in the Italian context, where the two terms tended to be applied almost interchangeably, despite the obvious contradiction between monist ontology and positivist reservation vis-à-vis any kind of ontology (Brömer 2000). In a discussion of a publication by his remote follower, Fabio Frassetto, in the *Annales des sciences naturelles,* Maggi expresses his cautious support for logical derivations:

> *If in [this work] there are theoretical conceptions, in addition to the facts, the former can all be called logical, and to me they prove that even in positive science, logic will find its place. On one occasion, I have been able to confirm by facts a previous logical assertion made by Dr. F. Frassetto.*[264]

At the same time, as we have seen throughout this chapter, Maggi himself was reluctant to go beyond the reporting of "facts", without so far entering into the elaboration of "theoretical conceptions". Of course, implicitly, general (biogenetic law) as well as specific expectations were clearly on his mind, but after the brief nod towards Frassetto, Maggi immediately returned to an "objective" description of particular details observed in the sutures of two human skulls he had been examining, and in the next study, he undertook an equally "detached" assessment of observations on horse skulls produced by Frassetto and by the Roman anthropologist Vincenzo Giuffrida-Ruggeri (1872-1921).[265]

It remains unclear, despite increasing mutual citations between Maggi and the contributors to the *Atti della Società Romana di Antropologia* at the turn of the century, if Maggi really had any further ambitions to join this particular branch of the Italian anthropological community (or, indeed, any other). Paolo Mantegazza, *doyen* of the Florentine approach to anthropology, certainly did not think so. This

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262 "… provenendo essi dalla scuola prettamente medico-chirurgica, invece che da quella dei naturalisti, che ha una cultura scientifica per la storia naturale a base più larga." (M267:156).

263 A. Gaudry (1883): *Les enchaînements du monde animal dans les temps géologiques. Fossiles primaires*. Paris: Savy, quoted in M267:156-158.

264 Se in esso, oltre i fatti, vi sono delle concezioni teoriche, queste si possono dire tutte logiche, e per me provano che anche nelle scienze positive la logica vuole avere la sua parte. Altra volta io ho potuto confermare coi fatti, quanto prima il dott. F. Frassetto disse logicamente. (M280:420 n.).

265 For a brief biography of Giuffrida-Ruggeri, who later taught in Naples, see Chiarelli & D'Amore (1997), vol. 1:440f., including bibliography and archival sources.

is what he said in response to Frassetto's suggestion that Maggi had inaugurated a new school of anthropology in Italy:

> *Poor Maggi, if he were still alive, would be the first one to laugh at the idea of being put at the head of a new school, just because he studied several anomalies of the skull, investigating their origins and comparing them with data from comparative anatomy.*[266]

But then, Frassetto certainly had not endeared himself to Mantegazza by opposing the "new approaches" represented by Giuseppe Sergi, Maggi, Achille De Giovanni, and Cesare Lombroso, implicitly against the "old" anthropology practised by Mantegazza and his collaborators. In one sense, however, it is hard to object to Frassetto, when he says, in his obituary for Maggi, that the late master died "when he was just getting ready to bring together the numerous extensive researches in craniogeny" – hence, any speculations about a potential later "school" of anthropology led by Maggi remain gratuitous.

[266] "Il povero Maggi, se fosse ancor vivo, riderebbe per il primo nel vedersi messo alla testa di una nuova scuola, solo perché ha studiato parecchie anomalie del cranio, ricercandone l'origine e confrontandole coi dati dell'anatomia comparata" (M[antegazza] 1905:92); review of Frassetto (1905a).

Research school

> [A] school's leader also bears major responsibility for such superficially "institutional" features as "access to or control of publication outlets" and "adequate financial support." When a research school is led by a talented, effective, and charismatic individual, these and other so-called "institutional" advantages are vastly more likely to come its way (Geison 1993: 235).

Despite Mantegazza's caustic remarks regarding Maggi's claim to school leadership (put forward not by himself, but by his follower Frassetto, we remember), the question of what significance a *caposcuola* held in the Italian context at the turn of the twentieth century certainly remains. In the last quarter of the twentieth century, two quite different concepts of "research schools" were proposed, one from the perspective of planned economy, aimed at improving scientific productivity through central administration (Mikulinskij 1977-79), the other from a liberal market viewpoint, describing the establishment and successful

competition of scientists and their pupils (Geison 1978).[267] For the Kingdom of Italy, with a generally liberal constitution, we can safely exclude the COMECON variety of research schools. Despite the cultural as well as economic demand for science and scholarship, which we have seen both in the symbolic context of national heritage and in the very practical concerns for infrastructure and public hygiene, there was no micro-management of local research environments Soviet style. The nearest equivalent could be the bursary scheme for graduate students to specialise abroad, which did result in some sort of identifiable intellectual traditions, but the specific destinations were left to the applicants to choose.[268]

Maggi and his contemporaries did use the term *caposcuola* (literally: schoolhead) quite frequently. If we look at Grassi's chronicle (1911), he confers this title to a great number of his subjects, without ever qualifying the meaning of the term. From the context, we can assume that all he meant was that the professor in question had a significant number of students whose approaches to their future research was recognisably shaped by their teacher's. Interestingly, in the case of Maggi, Grassi does not use the term *caposcuola*, though he does list a number of Maggi's pupils, among whom Grassi figures himself. All he has to say about his former teacher's contributions is expressed in nine lines of print – while he allows himself well over three pages:

> *Maggi and Pavesi divided zoology and comparative anatomy in Pavia between themselves after the death of Balsamo Crivelli. L. Maggi (1840-1905) made a major contribution to the spread of Haeckel's ideas. Of his varied and numerous publications, those on protozoans and the craniological ones merit special mentioning. He continued the beautiful traditions of his master G. Balsamo Crivelli, pushing the young students towards research conforming to the modern approach, though, alas, he was somewhat deficient in the new technique [sic].*
>
> *Among his students I remember Andres, Grassi, Cattaneo, C. Parona, Magretti, Bonardi, R. Zoia, R. Monti.*[269]

Maggi's immediate successor, Andrea Giardina, though not considering himself a disciple of what he saw as Maggi's "materialism", was far more positive. In an address delivered at the unveiling of a plaque dedicated to Maggi and Pavesi in 1913, he emphatically stated that Maggi was the "creator of a school", defined

267 See also id. (1981) and the quote above from id. (1993).

268 Dröscher (1992) analyses the scheme; ead. (1996) provides in-depth studies of specific traditions based on students' missions abroad in the field of cellular biology.

269 "Maggi e Pavesi si divisero a Pavia la zoologia e l'anatomia comparata, dopo la morte di Balsamo Crivelli. L. Maggi (1840-1905) contribuì largamente a diffondere le idee di Haeckel. Delle sue svariate e copiosissime pubblicazioni, meritano speciale menzione quelle sui protozoi e quelle craniologiche. Egli continuava le belle tradizioni del suo maestro G. Balsamo |116| Crivelli, spingendo i giovani alle ricerche secondo il moderno indirizzo, ma, disgraziatamente, gli faceva un po' difetto la tecnica nuova. Fra i suoi scolari ricordo Andres, Grassi, Cattaneo, C. Parona, Maretti, Bonardi, R. Zoia, R. Monti" (Grassi 1911:115f.).

mainly through the doctrine of evolution, which stimulated his students in their biological studies; the list of names he cites is somewhat longer than Grassi's.[270] Now, the fact of having graduates in itself is certainly not a yardstick for the role of a *caposcuola*. From the university yearbooks, we can see that each year, several dozen students enrolled in courses taught by Maggi, though the number of students entering a scientific career was obviously far more limited, as the teaching of natural history very often led towards a teaching career in secondary schools (even though, until very recently, the border between school and university careers in Italy was very flexible). It is thus helpful to consult an overview of the subsequent careers entered by Maggi's former research assistants, which he compiled for a report in 1899 (M260). There we learn, among others, that Corrado Parona was full professor (*ordinario*) for zoology in Genoa, Giacomo Cattaneo also full professor in Genoa, for Comparative anatomy and physiology, Paolo Magretti became a privateer entomologist, Edoardo Bonardi a pathologist, head physician (*primario*) at the Ospedale [Maggiore] in Milan, Luigi Forni a school teacher of Natural history. Raffaello Zoja had died in an accident (M226). Benedetto Corti became a science teacher in a secondary school, Giuseppe Soffiantini physician in a policlinic in Milan, the *Poliambulanza* of Porta Romana. At the time of writing (1899), Maggi's assistant was Rina Monti, who later was the first woman in Italy to be appointed to a full professorship, at the new university in Milan.[271]

Far more difficult to gauge would be the continuity of scientific approach, which would characterise a school, at least in the view of Maggi himself, which he formulated in 1887, not uncritically:

> *The craze among some of our teachers, wanting to be founders of a school right away, makes them often forget the right form of critiquing their colleagues' works. Others do not realise that the school, which they want to lead, is not produced by the simple establishment of facts, but it requires especially a scientific concept directing it, for which we need a broad familiarity both of the basic sciences and of the neighbouring disciplines to the one we are studying and teaching, which each teacher needs to possess.*[272]

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270 *Provincia Pavese* 26/27 May 1913. Giardina includes Corrado Parona, Giacomo Cattaneo, Battista Grassi, Ippolito Macagno, Paolo Magretti, Annibale Tommasi, Edoardo Bonardi, Angelo Andres, Maria Sacchi, Raffaello Zoja, Innocente Olivio, Rina Monti, and Giuseppe Paravicini. See also Bonardi (1913) on the event.

271 On Rina Monti, see Dröscher (2007).

272 "La smania, specialmente di alcuni nostri insegnanti, di voler essere tosto caposcuola, fa loro dimenticare soventi volte la vera critica dei lavori dei colleghi. Altri poi non si accorgono che la scuola, di cui vogliono essere capo, non è data solamente dal semplice ritrovamento dei fatti, ma vi concorre in modo particolare il concetto scientifico che l'indirizza, e pel quale necessita una larga coltura sia delle scienze fondamentali, sia di quelle affini alla scienza che si studia e s'insegna, e che ogni insegnante deve possedere." (M171: offprint p. 3).

Of the more prominent of Maggi's students, Grassi and Giardina quite openly distanced themselves from their master's ideology.[273] Cattaneo followed Maggi's approach quite literally, especially in his studies on fundamental forms of living organisms and on organismic individuality. Actually, these works are more Haeckelian in their outlook than most of Maggi's. Parona and Bonardi, too, continued in directions not dissimilar to Maggi's, while Monti diversified her range of interest, without openly rejecting the ideas absorbed in Pavia. On balance, one could cautiously argue that there was a detectable transmission and development of approaches and ideas, especially via the important university chairs in Genoa and later at the new university of Milan, where Monti went to teach.

The intellectual foundation of this tradition, which Giardina was rash to equate with materialist evolutionism, was seen very in a more articulate way by Maggi, who about a year before his death discussed this issue in a letter to his follower Fabio Frassetto:

> *My school does not neglect the discussions of Cuvier's anatomo-physiological and Serres' anatomo-ontogenic laws, H. Milne Edwards' so-called natural trends, and so forth, given that function also has its value in morphology. […] My school is with Cuvier, Owen, Huxley, Zittel, Seeley, Gaudry,[274] and other leading palaeontologists regarding the importance of the ancient, preceding the present; it is with Gegenbaur regarding the union of comparative anatomy with ontogeny and of ontogeny with palaeontology; eventually, it gives due consideration to general and specialised works with morphological orientation as indicated by the current literature, and it takes into account the results of all physiological and morphological research, especially morphogenetic studies, in order to arrive at a critical comparative anatomy and physiology; which is the culminating point of any science (Maggi, ca. 1904).[275]*

273 As we have stressed above, in the case of Grassi, it even appears too limiting to reduce him to a student of Maggi's, given his very early wide-ranging national and international experiences.

274 On Etienne Serres (1786-1868), a follower of Etienne Geoffroy Saint-Hilaire, see Russell (1916:79-83 and *passim*), on the Meckel-Serres law, ibid. pp. 91-101.
Karl Alfred von Zittel (1839-1904); on id. (1876): *Handbuch der Paläontologie*, see Rupke 1976:59 n.19. Zittel's work on selachians from his *Grundzüge der Paläontologie* (1895) is discussed in Ranke (1900:448-451). Zittel was also an important historian of palaeontology, whose *Geschichte der Geologie und Paläontologie bis Ende des 19. Jahrhunderts* (München: Oldenbourg 1899) was still read half a century later (Rupke 1994a:263 and fn. 6).
Harry Govier Seeley (1839-1909), British palaeontologist.
Albert Gaudry (1827-1908), French geologist and palaeontologist.

275 "Tuttavia la mia scuola non tralascia le discussioni sulle leggi anatomo-fisiologiche di Cuvier, su quelle anatomo-ontogeniche di Serres, sulle così dette tendenze della natura di H. Milne Edwards e così via, giacché la funzione ha pure il suo valore anche in morfologia. | La mia scuola è con Cuvier, Owen, Huxley, Zittel, Seely [sic], Gaudry ed altri sommi paleontologi per l'importanza dell'antico, antecedente all'attuale; essa è con Gegenbaur per l'unione [errore di stampa] dell'anatomia comparata coll'ontogenia e dell'ontogenia colla paleontologia; essa, infine, tiene nella dovuta considerazione le opere d'indole generale e di specialità con l'indirizzo morfologico come ci indica la bibliografia attuale, e tien calcolo dei risultati di tutte le ricerche

One of the interesting observations to be made regarding this short text is the absence of any specific anthropological references – considering that the recipient was an anthropologist. Maggi's model for his craniological research, despite occasional references to anthropologists such as Ranke or Welcker, was primarily Gegenbaur's *Kopfskelet*. The other striking absence is of course Haeckel; however, the published text consists only of extracts from the original letter, which do not cover protistology, and although Maggi's craniology was motivated by Haeckel's biogenetic law, Haeckel had not produced specific work of immediate relevance to Maggi's collection of "facts", so he would not be cited in this particular context.

With regard to Geison's reminder that, in order for a research school to flourish, its leader needs to provide institutional and material sources, Maggi does score relatively high. Perhaps most importantly, the *Bollettino*, which he was instrumental in editing over more than twenty years, provided his students with an opportunity to publish their first scientific results. Therefore, scanning through the pages of this journal, we get quite a complete summary of the research activities pursued in the laboratories in Pavia, mostly in comparative anatomy and physiology, but also in human anatomy (Zoja) and others, who took advantage of the opportunities to publish in the bulletin. Material resources were harder to come by. The Kingdom was not a wealthy country, and its history of territorial fragmentation had bequeathed to the state a very high number of fiercely competing universities.[276] The main concern for Maggi's institute was space: Rooms for the museum collections, rooms for teaching and research laboratories. As early as 1879, Maggi had begun to campaign for the provision of new rooms (M95), a recurrent theme throughout his career. He succeeded in this effort, as we have seen, at the very end of his life. Funding for the museum collections came from various sources, mostly from the *Consorzio universitario*, the state funding body of the university, but also from private donations, which he would promptly acknowledge in the published descriptions of the new specimens (e.g., M93). The increase of the museum collections under his directorship were considerable, providing a variety of research material for himself as well as his students.[277]

A final consideration regards Maggi's communication beyond his immediate disciplinary community. This aspect is of particular interest in his case, given that, despite the "unitarian" background, Maggi's research covered such a variety of subjects in areas, which were still in the process of being circumscribed as disciplines. As we have seen, early on in his career, Maggi began to write about his special interest for a wider audience. The distinction between more technical and

fisiologiche e morfologiche, specialmente morfogeniche, per arrivare all'anatomia e fisiologia comparate *critiche*; punto questo culminante di ogni scienza." From a letter Frassetto had received a year earlier, partly edited in Frassetto 1905, p. 322n. (omission and emphasis as in edited version, erroneously repeated phrase removed).

276 See Polenghi (1993), Porciani (1994)

277 Barbagli & Rovati (2002).

more popular writing was however not all that clear. Thus, for example, the local newspaper of Varese, *Cronaca Varesina*, carried quite specialised articles about Maggi's research in the context of the prehistoric excavations and the creation of the *Museo patrio*. On the other hand, not unlike some of his contemporaries, even when writing for academic periodicals, Maggi had to adapt his style to their interdisciplinary nature, before the establishment of more specialised journals from the late 1870s – although it needs to be said that not a few of the papers printed in the *Rendiconti* are quite technical, indeed.[278] Yet, when we look at one of Maggi's few "occasional" pieces in comparative anatomy, we observe that he explains technical terms and systematic names for the non-expert audience. Presenting the results of a dissection performed in a White-tailed Sea-eagle, he uses the current binomial name *Haliætus* [sic] *albicilla* Bp., but in the second paragraph points out that he is dealing with an *Aquila di mare* (the vernacular name), or *Falco albicilla* Lin., the original classification given by Linné.[279] And again, when dealing with the biliary system (*apparecchio biliare*), he introduces the gall bladder with the vernacular term *vescicola del fiele*, before switching to the more technical *cistifellea* (M55).[280] Thus, the difference is not so big when comparing this article, penned for the proceedings of the *Istituto Lombardo*, with the style of his first little monograph on infusorians, published by a cultural magazine (M45), where on the contrary, he frequently fails to explain rather technical terms. We may indeed wonder what the average literate Lombard would make of a phrase like the following, chosen at random, which refers to Claparède and Lachmann's research into the fine structure of infusorians:

> *Certainly, these beings have integuments, appendicular organs, a parenchyma, a digestive system, a circulatory apparatus, and a reproductive system.*[281]

Stylistic incongruities are recurrent in Maggi's publications, and we have seen several examples of that phenomenon throughout this thesis. Some of his writings are extremely dry and factual, in others he has taken poetic licence, but especially his more theoretical memoirs have been accused by even well-meaning contemporaries of lacking clarity – for that, too, we have seen a number of examples. Compared to some of the later writings of his venerated model, Ernst

278 On the role of specialised journals for the development of mid-nineteenth-century zoology, see Nyhart (1991).

279 "*Haliaëtos* Bonaparte, 1826, *Ann. Lyceum nat. Hist. New York*, **2**: 24, 25 (an incorrect subsequent spelling for ***Haliaeetus*** Savigny, 1809)", ICZN (2007): *Official Lists*, s.v. "Haliaëtos". The describer was one of the leading ornithologists of the nineteenth century, Franco-Italian Charles Lucien (Carlo Luciano) Bonaparte (1803-1857), nephew of the French Emperor, and an important figure in the *Risorgimento*; see Stroud (2000). His bird collections are now preserved in the Certosa di Calci, Pisa, Italy.

280 The term *cistifellea* is quite established in common parlance as well.

281 "Decisamente, questi esseri, hanno degli integumenti, degli organi appendicolari, un parenchima, un sistema digerente, un apparecchio circolatorio ed un sistema riproduttore." (M45:7).

Haeckel, we have to say that Maggi's was less appealing to a wider audience, which might be one of the reasons why his grand visions did not propel him above the station of a "little-grand man". But this kind of counterfactual speculation obviously is not of much use historically. For the fate of his school, if we agree that his students and followers did constitute one, we are left with his most established disciples, and certainly by the standards of Grassi's *capiscuola* we can safely say that Maggi left a Haeckelian mark on the teaching of comparative anatomy and of zoology in northern Italy at the turn of the century, and he strengthened his own institute and museum to an extent that today is still discernible, while the institute is again on the move to the new, twenty-first century incarnation of Palazzo Botta.

Conclusion: Actor in fleeting networks

Charles Darwin has been surprisingly little mentioned in the preceding chapters – as, indeed, he is very rarely mentioned in Maggi's works. This observation should not be taken as supporting evidence for the "eclipse of Darwinism" at the turn of the century (Bowler 1983). Insofar as such an eclipse can be construed at all, with the rise of orthogenetic ideas (Rosa 1899, 1918) and a revival of vitalism in Italy (Grassi 1906),[282] these developments did not take root until after Maggi's death. Rather, it could be argued that basic tenets of Darwin's theories had been woven into the fabric of biological research without requiring repeated explicit acknowledgement. Two specific aspects need to be considered in the case of Maggi: His primary interest, once the 'origin of life' question became obsolete in the 1870s, lay in the establishment of genealogical relationships between living organisms (phylogeny), not in the study of *mechanisms* of descent. He basically took natural selection for granted, as his excursion into "bacteriotherapy" shows, where he applied Darwinian "struggle for life" to the elimination of pathogenic microbes by "fitter" groups which happened to be harmless to humans. Secondly, from the

282 Grassi's address, which Cipollini (1984:119 and n. 14) defines as of "his text of major theoretical commitment" ([il] "testo di maggior impegno teoretico"), was delivered in a "solemn session" of the *Accademia dei Lincei* in Rome on 3 June, 1906, and subsequently published as a separate volume by that academy, but also included in the proceedings (*Rendiconti dell'Accademia dei Lincei, adunanza solenne* 2, 1906:219-239) and republished in the journal *Rivista d'Italia* (Grassi 1906).

perspective of a phylogeneticist, he had more use for Haeckel's project of a "general morphology", encompassing the entire world of the living (if not even the cosmos as a whole), rather than the intricacies of *the variation of animals and plants under domestication*, *the expression of emotions*, or the *formation of vegetable mould through the action of worms*.[283] Thus, from Maggi's point of view, it was entirely plausible to proclaim Haeckel as Darwin's successor, the one who had completed Darwin's work systematically (in the two senses of "in a systematic fashion" and "in systematics"). The relationship between Haeckel's and Darwin's theories has exercised biologists and historians of biology ever since Haeckel proclaimed his support for Darwinian evolution in 1863. As long as Darwin was alive, the two men corresponded regularly and cited each other's works, displaying a general agreement in their basic ideas, despite their different emphases and contrasting temperament. On a conceptual level, the differences between the two naturalists clearly exist in degree, not so much in kind, as Richards has just demonstrated through a detailed comparison between their ideas, not only in their published works, but also in their correspondence and Darwin's early notebooks (Richards 2008: 135-162).

Haeckel's presence in Italy was quite different to Darwin's. Not only did he travel in the country almost annually, meeting Italian colleagues and contributing to academic and political events,[284] but his outspoken monist ideology resonated with the convictions of leading intellectuals in post-*Risorgimento* Italy, far more than the circumspect expressions Darwin used in his public statements (Brömer, 2009). It is therefore not surprising to see Maggi refer (and defer) to Haeckel rather than Darwin, especially as we have seen how intimately Maggi's formation had been intertwined with the formation of the unitary state, the Kingdom of Italy, right from its very beginning during his student days in Pavia. And yet, it has also become abundantly clear that Maggi's role cannot be reduced to that of an emulator and transmitter of Haeckel's ideas and ideologies, and even less to that of an "eclectic naturalist", if that is to mean that the subjects he studied were elected randomly, applying various methods haphazardly. On the contrary, this microstudy provides insights into the complexities of scientific and related practices performed by an actor who quite consciously saw himself as a member of different groups at different times, even though he had to realise that he was not always successful in attaching himself to new communities, as in the case of the "Florence style" anthropology around 1890, and he could even appear somewhat petulant, when for instance he complained about the lack of references to his craniological work in Ranke's overview on supernumerary bones published in 1900.

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283 Thus the titles of Darwin's main later works, first published in 1868, 1872, and 1881, respectively, all of them by John Murray in London.

284 Krauße (1993); Foa (1998): 1-34.

What were those networks in which Maggi partook, and to what effects? Initially, as a student and a junior lecturer, he had been socialised into an existing group of quite interdisciplinary composition closely following the French debate on spontaneous generation (chapter 4). Through Giovanni Cantoni, the group's physicist, they made personal contact with the British wing of the project, with Henry Charlton Bastian adopting the results from experiments conducted in Pavia for his own voluminous works on the *Beginnings of Life*. Maggi remained faithful to heterogenesis research even after the group dissolved, with Mantegazza's departure for Florence and Balsamo Crivelli's death in 1874, leaving only Cantoni for Maggi to work with. It was right at that time that Maggi made the step from investigating observations made elsewhere to proposing an original concept to account for the granules observed in the presumed spontaneously generated organisms, the "plastidular theory". He coined a term almost identical to that used in exactly contemporary works by Haeckel and Elsberg, though, as we have seen, the concepts were quite different, and Maggi discussed these differences in great detail. His observations subsequently appeared to be compatible with Richard Altmann's bioblasts – obviously, an unanticipated outcome, to which Maggi's students Luigi and Raffaello Zoja drew the attention of both Altmann and Maggi. We can certainly argue that the relevance of this parallel development does not lie in any kind of priority dispute (the possibility was not raised by either of the protagonists, who were quick to acknowledge each other's contributions), but it shows that anatomists in Pavia and Leipzig were involved in research covering overlapping topics that were relevant at the time, even though it must be admitted that our historical knowledge of late-nineteenth-century cell organelle research is still quite limited. Thus, Altmann's work, in particular, tends to be read as the "discovery of mitochondria", though in the "discoverer's" concept, these *bioblasts* had nothing at all in common with what later was described with Carl Benda's term *mitochondria*, first proposed in 1898, eight years after Altmann's publication – nor can in fact Benda's organelles simply be equated to what in the early twentieth century was characterised as a possible endosymbiont, a presumably erstwhile independent microorganism.[285] This distinction did not stop near-contemporaries from "identifying" bioblasts with mitochondria, as did Jules Duesberg in 1912.[286]

Thus, if we want to continue the use of the "network" metaphor, we need to conceive of these nets as highly fluid structures of changing nature: They can at one point in time be characterised by an ontological concept (the origin of life),

285 See Ernster & Schatz (1981) for a brief history of mitochondria. The authors, however, do appropriate Altmann's bioblasts as the first observed mitochondria.

286 Pensa (1913). Recent historians have been more cautious. Thus, Dröscher (1996) does refer to the links made by Duesberg and others between plastidules and mitochondria, but she does this in her chapter on mitochondria (pp. 120f.), using early twentieth-century actors' categories, whereas she consistently avoids any references of that kind when analysing Maggi's plastidular theory in the context of the 1870s' study of the "cytode" from the perspective of protoplasmatic theories (pp. 92-94).

transform into a net held together by a term with consciously incompatible uses (Haeckel, Elsberg and Maggi's plastidules), and next be spread out over differently named, but presumably identical objects (Maggi's plastidules, Altmann's bioblasts, Benda's mitochondria). Each one of these fleeting structures plays its role in organising and directing research, morphological experiments, histological staining techniques, biochemical analyses – but each of these metaphorical relationships is also a temptation for contemporary actors as well as later historians to reify the transitory objects of these researches, forcing them into a progressive lineage. After all, should we not say that it was Leopoldo Maggi who discovered mitochondria? My main objection to this thought is the following: The retrospective appropriation of Altmann's research, as commonly practised, for the history of mitochondria erases the activities and research interests Altmann pursued, and while it tells us little about mitochondria, it tells us nothing about subcellular research in the 1880s and 90s, which were precisely not about cells as the elementary unit of life, containing within them subordinate structures. On the contrary, Altmann (as well as Maggi and Cattaneo before him, and Haeckel in his early works, which we have discussed above) had been looking towards a gradual concept of individuality, positing the *Elementarorganismus* at a level below that of the cell. This entire research programme, which led to unexpected yet productive results (of which the endosymbiont theory is but one example) has been largely obliterated from history because of the lure of semantic transformations, from the *vibrio*s and *Hefezellen*, *plastiduli* and *Bioblasten*, to the mitochondria, with the last mentioned undergoing change beyond recognition over the first three or four decades of their existence.[287]

Similarly, the Darwinian frame of reference imposed on much of the history of nineteenth-century biology, especially in the case of Italy, turns out to be too tight to encompass many of the activities which even as committed an evolutionist as Maggi was engaged in. The dominant theme of Italian intellectual life throughout the nineteenth century was unification, unity, even some degree of homogenisation, if we take seriously D'Azeglio's injunction to "make Italians". The sense of competition, struggle, domination only develops gradually, towards the end of the century, and with catastrophic results for the Italians as well as for

287 Even eminent historians of biology are not immune to the temptation of Whiggish historiography. Thus, in a reprint of her edition of seminal texts in cellular theory, Jahn (2003:45) contemplates jettisoning Max Schultze's paper of 1861, because his rejection of cell membranes in animal tissues could not be considered an "improvement" over Schwann's original definition (see Scharf 1990). Once we begin taking seriously the work of Maggi, Altmann, etc., we realise that cell research in the second half of the nineteenth century was by no means a simple, linear programme, continuing on an imagined trajectory from Hooke and Leeuwenhoek in the seventeenth to Schleiden and Schwann, Virchow, and straight on to electron microscopy in the mid-twentieth century: Debating the nature of cells and subcellular units was a perfectly legitimate and productive area of research during the period we have just been discussing.

the "objects" of their desire, peoples in the east and north of Africa (Labanca 1993), with the ensuing rise of racism after 1900 (Maiocchi 1996, 1999). Accordingly, for Maggi, Haeckel's *Generelle Morphologie* offered a perspective for unity in the natural world, demonstrating the genealogical relations between all living organisms. The mechanisms of selection, while taken for granted at an abstract level, never were his primary concern.[288] Yet, as we have seen in chapter 7, a current in Italian anthropology aimed at establishing racial hierarchies was beginning to form at the turn of the century, mainly in the wake of Giuseppe Sergi's "qualitative" craniology – but there is nothing to indicate that Maggi had been in the least attracted by these aspects of his Roman colleague's work during the last years of his life. Any references to race are extremely marginal in Maggi's craniological publications, in which he rather sought to corroborate Haeckel's biogenetic law to prove common descent of craniate animals. In this work, Maggi latched on to another broad network, including anatomists and palaeontologists both in Italy (such as Romiti, Ficalbi, Chiarugi) and abroad (notably, Gegenbaur, Welcker, Zittel, Ranke, and several others).[289] And it was important for him to be seen as belonging to this group, as we can tell from his complaint about Ranke's omission, in his survey, of Maggi's work. His link to the Italian anthropological network was equally problematic. In a conservative reading, short of Frassetto's enthusiasm for proliferation, we could identify two major nodes of anthropological approaches, one in Florence, the other in Rome. Maggi only ever published one paper in an anthropological journal, the Florentine *Archivio*, in 1890, which at the time was the only specialised journal in Italy.[290] Although the editor of the *Archivio*, Mantegazza, had been Maggi's senior colleague in Pavia back in the 1860s, we have already noted that their relationship seems to have dissolved completely after Mantegazza's departure. Nevertheless, the *Archivio* continued to cover Maggi's work in various forms, from brief reviews to extensive excerpts, without giving much room to Maggi's philosophical speculations. We could say that the anatomist from Pavia was passively held in the loop of the Florentines, as a peripheral presence, without himself exerting an active influence over the way in which he was portrayed. The "Romans", on the other hand, quite often cited Maggi approvingly. Fabio Frassetto, in particular, but also Vincenzo Giuffrida-Ruggeri were involved in research along the lines of Maggi's, and although the latter never published in the *Atti*, he played a far more active role in the "school" established by Sergi, though the "supernumerary bones" project was rather peripheral for the "Romans", and certainly for Sergi himself, whose qualitative description of skull shapes became increasingly geared towards questions of race and hierarchies. But Frassetto, as we have seen, did regard Maggi's contributions as sufficiently important to postulate the emergence of a "Maggi school of

288 Except in his suggestion of "bacteriotherapy".
289 See chapter 8.
290 The *Atti* in Rome were only launched in 1893.

anthropology", cut short, as it were, by the *caposcuola*'s sudden death, as he deplored in his obituary, while Mantegazza mercilessly ridiculed the idea of a Maggi school of anthropology.

Another, more tangible network was Maggi's "school" in comparative anatomy, as several of his graduates went on to hold important positions in other (mainly northern) Italian universities and hospitals, notably, Giacomo Cattaneo, Corrado Parona (both Genoa), Rina Monti and Edoardo Bonardi (both eventually Milan), and several others. Cattaneo, in particular, remained devoted to "Haeckelian" themes and ideas, such as questions of fundamental forms and elementary organisms. Battista Grassi, on the other hand, though the most famous Pavia graduate of his generation, was also the most distant personally and intellectually. Though having studied with Maggi, he would hardly refer to himself as the latter's student, and it is probably true to say that Grassi had been so independent and proactive early on in his career, working with Golgi (Maggi's "nemesis"…) and Bizzozero in Pavia, but also in Heidelberg and Würzburg,[291] so he would not easily consider himself one master's disciple, and after 1900 he became one of the first supporters of neo-vitalism in Italy, a concept that was profoundly at odds with Maggi's materialist philosophy.

Where does all that leave Maggi, the "typical little-grand man of the second half of the nineteenth century", as we heard Lanzavecchia (2002:9) define him at the beginning of this thesis? It is beyond any doubt that Maggi was not a character like Pasteur, who would drag his surrounding network with him wherever he went, from demonstrations with fancy bottles to inoculations with attenuated pathogens and other areas still. He was not a notorious personality like Haeckel, who would deliberately incense the wider public with provocative ideological statements. Maggi's popular lectures, after all, were always quite moderate in tone, though uncompromising in content. He was not a mobile scientist like Battista Grassi, either. While Grassi kept travelling, attending congresses abroad, and succeeded in gaining high international status with his malaria research (not quite high enough for the Nobel price – but almost), Maggi mainly confined his activities to the western half of Lombardy, with the occasional excursion to Genoa and rare official presences in Rome. The results of his scientific work were acknowledged internationally, but it did take us some searching to find references in Bastian, Spee, and a few others. Partly, this limited success can be explained by the fact that he was wedded to a biological programme which was in decline at the turn of the century, both methodologically (with the advent of developmental mechanics practised by Roux) and ideologically (with the spread of orthogenetic and vitalist ideas in the works of Rosa, Grassi, Driesch, etc.) – but then, so was Haeckel, who nevertheless maintained a high profile for almost another fifteen years after Maggi's death.

291 As a beneficiary of the Italian international bursary scheme, Dröscher (1992).

But the aim of this thesis has never been to promote Maggi from the second to the Premier League of nineteenth-century Italian academia. His case is interesting precisely because it is in many ways typical for an Italian scientist of the late nineteenth century, a person who, after the hard-won creation of a national state he identifies with, finds himself in a somewhat peripheral position on the European map of science,[292] conscious of a more glorious past, which he and many of his colleagues intend to resurrect, limited by scarce resources and pressing needs of a comparably poor country, committed to furthering the practical (medical) and symbolical (historical) causes at home, but also trying to engage in the international scientific debates, from French and British spontaneous generation to German (and Italian) general morphology and comparative anatomy, all the while struggling to secure the immediate institutional resources required for the continuation of his work, in the face of a changing scientific and academic environment, with threats coming from competing research programmes (Golgi) as well as from teaching reforms. The picture that we have painted is thus organised towards a vanishing point in the person of Leopoldo Maggi, while the reticulate structures arranged around him are ever shape-shifting, floating in mostly unpredictable directions (and sometimes sinking without a trace).

In conclusion, we can say that Maggi, by taking Haeckel's morphological work seriously and resisting the polemical confrontations so characteristic for the scholar from Jena, established Haeckelian ideas in a significant part of Italy's zoological community at the turn of the twentieth century, notably a comparative approach to general morphology based on the "biogenetic law" of ontogeny briefly recapitulating phylogeny. At the same time that he was pursuing this programme in more or less subtle ways, however, Maggi also undertook and initiated thoroughly practical research, addressing the immediate needs of human and agricultural hygiene in the young State, and secured his own and his students' institutional survival, which is something that quite distinctly sets him apart from Haeckel and many other colleagues in countries with more generously funded research and education systems, many of whom insisted (and were able to insist) on a greater academic "purity" of their *Grundlagenforschung* (basic research), a conflict which periodically waxes and wanes, but never ceases to be an essential element of scientific practice.

292 North America hardly figures at all in Maggi's field of vision – though Elsberg did his research in New York.

Appendix 1: Leopoldo Maggi's Letters to Ernst Haeckel, from the Ernst Haeckel Archive, Jena

(transcription of the original texts in Italian, with English translation[293])

Pavia Li 30 gennajo 1884.

[R. Universita di Pavia
Museo
di
Anatomia e Fisiologia
Comparate][294]

Illustre Professore Hæckel.

Dal 1866, epoca della comparsa della vostra Generelle Morphologie, io ho sempre tenuto dietro alle vostre pubblicazioni, abbracciando interamente il vostro indirizzo morfologico per lo studio dell'organizzazione animale; e la mia considerazione per il vostro sapere, andò crescendo talmente da impedirmi che io osassi domandarVi la vostra relazione personale tanto da mé ambita. D'altra parte mi asteneva dal scrivervi, per mostrare ai miei colleghi che se il nome vostro era sempre sulle mie labbra nella mia scuola, sulle mie pagine nei miei scritti, non era per amicizia, ma sibbene per profonda convinzione scientifica dei risultati dei vostri studj; a testimonianza della quale, se non arrivano le mie povere ricerche, spero potranno essere presentate quelle del mio distintissimo scolaro Dott[r] Giacomo Cattaneo. Egli è certo però che dal giorno in cui sono salito sulla

293 I am most grateful to my friend Ben Marsden (Aberdeen, Scotland) for his revision of the English translations; any remaining errors are of course my own responsibility; RBr.

294 Letter head embossed.

cattedra di Anatomia e fisiologia comparate di questa Università, /2/ che fu nel novembre 1874, le vostre idee da mé discusse, d'allora in poi, in Italia, scossero gli studiosi; ed in oggi il nome vostro è proferito da molti, e l'Hæckelismo è già stato proclamato nella mia scuola far seguito al Darwinismo. La Dottrina Hæckeliana è, per mé, il pabulum della mia vita scientifica, se questa mi è permessa d'avere; epperò la vostra Dottrina è anche quella che mi impiccolisce davanti a Voi, sicché non mi sarei mai presentato personalmente, se in oggi non potessi dirVi che il R. Istituto Lombardo di Scienze e lettere di Milano, su mia proposta, Vi ha nominato suo Socio corrispondente. E' un tenuissimo attestato, non pari certamente all'estimazione che vi si deve; ma è tutto quello che noi possiamo dare anche ai grandi cultori della scienza.

Accettatelo pertanto di buon animo, [...][295] ne /3/ godremo io ed i miei colleghi e tutto il Corpo Accademico, dal quale presto Vi sarà spedita la lettera di nomina.

A mé poi permettetemi di intrattenermi qualche volta con Voi, e frattanto accogliete i sensi della mia più alta stima, e credetemi

Vostro devotissº

Prof. Leopoldo Maggi.

Pavia, January 30th, 1884.

[Royal University of Pavia, Museum of Comparative Anatomy and Physiology]

Illustrious Professor Haeckel.

Since 1866, the time when your *Generelle Morphologie* appeared, I have always kept up with your publications, embracing entirely your morphological approach to the study of animal organisation; and my consideration for your knowledge kept growing to a point that it prevented me from daring to ask for that personal contact with you that I so desired. On the other hand, I refrained from writing in order to demonstrate to my colleagues that if your name was constantly on my lips in my school, on the pages of my writings, this was not from friendship, but out of profound scientific conviction of the results of your studies; testimony of which, if not coming from my own poor researches, I hope will be presented in those of my distinguished student Doctor Giacomo Cattaneo. It is however certain that from the day that I took up the chair of Comparative anatomy and physiology of this university, |2| which happened in November 1874, your ideas, as discussed by myself, subsequently stirred the scholars in Italy; and today, your name is professed by many, and Haeckelism has been declared by my school to be the successor to Darwinism. Haeckelian Doctrine, for me, is the *pabulum* of my scientific life, if such I may be permitted to lead; and yet, your Doctrine is also

[295] Deleted word.

what belittles me before you, which is why I would never have presented myself personally to you, were it not that I could tell you today that the Royal Lombard Institute for Science and Letters in Milan, on my proposal, has nominated you as a Corresponding Member. This is a very slight recognition, surely not on a par with the esteem you are due; but this is all we can give even to the great cultivators of science.

Thus, accept it in good spirit; this will bring joy to myself, my colleagues and the entire body of academics, on whose behalf you will soon receive the letter of nomination.

As concerns me, allow me on occasion to converse with you, and in the meantime accept my feelings highest esteem, believe me,

your most devoted Prof. Leopoldo Maggi

Illustre Professore!

Pavia 9 Maggio 1884.

RingraziandoLa del suo ritratto, che, come Hæckelismofilo, terrò sempre caro; mi pregio di offrirLe il mio. Se ho ritardato in questo contracambio, è perché io non aveva ritratti, ed ho dovuto farlo fare.[296]

A tempo più opportuno Le parlerò della corrente Dohrniana, che si introduce in Italia a danno degli Hæckelisti, e quindi anche a danno del mio distinto scolaro Dott[r] Giacomo Cattaneo.

Accolga i sensi della mia più alta stima, e mi creda suo Devots[o].

Prof. Leopoldo Maggi.

Illustrious Professor!

Pavia, May 9th, 1884

With greatest thanks for your portrait, which will always be dear to me, as a Haeckelismophile; I am taking the liberty of offering you mine. If I have delayed this exchange, it is because I had no portraits, and had to have it made.

At a more opportune moment, I will tell you about the Dohrnian current, which is spreading in Italy at the expense of the Haeckelists, and hence also to the detriment of my distinguished student Doctor Giacomo Cattaneo.

Accept my feelings of highest esteem, and believe me

your most devoted Prof. Leopoldo Maggi

[296] The portrait has been reproduced in CISST (ed., 1993), p. 87, no. 69, though the caption erroneously reads "M. Lessona" (while Lessona's portrait on p. 82, no. 64, is wrongly described as Maggi's).

Illustre Professore!

Pavia 12 Aprile 1889.

Ho ricevuto in questi giorni, per mezzo del librajo Hoepli, la sua grand'opera sui Sifonofori[297] con magnifiche tavole, e che Ella gentilmente e generosamente volle donarmi fin dal dicembre scorso. Io Le sono riconoscentissimo per ciò, e La prego di accettare i miei più vivi e cordiali ringraziamenti.

Seppi dal Prof^e^. Parona che Lei era, poco tempo fà, a Genova di passaggio per l'Isola d'Elba; ho veduto sui Giornali politici di jer l'altro che si trovava a Roma, e noi di Pavia non potremo avere l'onore di vederLa? Sarebbe per noi un gran giorno di festa quello della sua presenza in Pavia. Dal 24 al 30 corrente io sarò a Roma per una commissione, poi a Pavia, ed allora ci saranno anche i miei colleghi e gli studenti che goderanno immensa= /2/ =mente della sua preziosa visita. Comunque, io La prego di ricordarsi che qui noi tutti desideriamo di fare la sua conoscenza personale, essendo il suo nome non solo scientificamente noto, ma anche popolare.

Accolga intanto i rispetti di chi, colla massima stima, si rafferma

Suo Dev°.
Prof^e^. Leopoldo Maggi.

Illustrious Professor!

Pavia, April 12th, 1889.

I have received at this time, through the publisher Hoepli, your great work on the siphonophores with magnificent plates, and which you have kindly and generously intended to donate to me since December last. I am most grateful to you for this gift, and I hope you will accept my most lively and cordial thanks.

I learnt from Prof. Parona that you have recently passed through Genoa, on your way to the island of Elba; I read in the political newspapers of the day before yesterday that you could be found in Rome, and we in Pavia could not perhaps have the honour of seeing you? The day of your presence in Pavia would be a great day of celebration for us. From the 24th till the 30th inst., I will be in Rome for a commission meeting, afterwards in Pavia, and then my colleagues and students will also be here, all of whom would immensely enjoy your precious visit. Be that as it may, I would like to remind you that we all desire to become personally acquainted with you, as your name is known not only scientistically, but also popularly.

In the meantime, accept this expression of respect, with the highest esteem, I assure you,

your devoted Prof. Leopoldo Maggi

297 Presumably *Report on the Siphonophorae collected by H.M.S. Challenger*. London: Murray, or could be *Zur Entwicklungsgeschichte der Siphonophoren*. Utrecht: van der Post, 1869. The former contains 50 plates, the latter 14.

Pavia 28 Aprile 1892.

Illustre mio Collega!

Appena arrivato quì, ho trovato le sue bellissime preparazioni di Radiolarie a me dirette, La ringrazio vivamente dell'importante suo dono, ed in modo particolare poi sento di esserLe grato per la sua buona memoria a mio riguardo.

Il desiderio di fare la sua conoscenza personale, è per mé grandissimo, come lo è anche dei miei colleghi di Pavia. Quanto Le avrei stretta volontieri la mano!

Auguro alla sua Signora che si ristabilisca presto in salute e che stia sempre sana.

Invoco l'occasione propizia di poterLa avere presto tra noi, ed io sarei felice di tenerLa mio ospite.

Accolga i cordiali saluti del

Suo Affez.º
P. Leopoldo Maggi.

Pavia, April 28th, 1892.

My illustrious colleague!

On returning home, I have found your most beautiful preparations of radiolarians which you sent me. I thank you most warmly for your important gift, and particularly, I am feeling most grateful to you for thinking well in my regard.

The desire to make your personal acquaintance is very great for me, as it is also for my colleagues in Pavia. How I wish I could shake you by the hand!

I wish your Signora that her health may soon recover and that she be always well.

I invoke a propitious occasion to have you with us soon, and I would be happy to offer you my hospitality.

Accept these cordial greetings of your

most affectionate Prof. Leopoldo Maggi

Illustre Professore!

Pavia 29 Nov. 1893.

Mi compiaccio mandare alcune mie Memorie pel suo Laboratorio, come da avviso ch'ebbi gentilmente da Lei. Delle altre, non ho più nessuna copia a parte. Spero quanto prima di inviarLe la seconda edizione della Protistologia,[298] aumentata non solo alle classi da Lei introdotte ultimamente, ma anche con quella dei Gliari (Batibj di Thomson, Carpenter, Bessels[299] e Afanerogliari d'acque dolci *mihi*), e cogli ordini Bacteri afaneri e Fitobacteri.

Le faccio i miei vivi auguri pel capo d'anno e sempre sperando di poterLa vedere di persona, mi raffermo colla massima stima

Suo Devot.mo
Prof[e]. Leopoldo Maggi.

Illustrious Professor!

Pavia, Nov. 29th, 1893.

I take the liberty of sending you some of my memoirs for your laboratory, according to your kind expression of interest. Of the others, I do not have a single offprint left. I hope to be able to send you as soon as possible the second edition of the *Protistology*, expanded not only with the classes you have recently introduced, but also with those of the gliarians (the Bathybii of Thomson, Carpenter, Bessels, and freshwater aphanerogliarians of mine, and with the orders of aphanerous bacteria and phytobacteria.

I am sending you my best wishes for New Year's Day, and am always hopeful to be able to meet you personally. I assure you, with greatest esteem,

your most devoted Prof. Leopoldo Maggi.

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298 A dedicated copy is preserved at the Haeckelhaus in Jena.

299 Wyville Thomson, William Carpenter, and Emil Bessels. Haeckel discusses the Bathybius episode, including some of the criticism levelled against the identification of this "organism", in his *Protistenreich*, Haeckel (1878): 73-82. See also Rupke (1976).

Illustre Prof^{e} Hæckel.

Pavia 8 Genn. 1894.

Ricevo un'invito [sic][300] per festeggiare il di Lei sessantesimo anno di vita, e mentre ciò mi fà un grandissimo piacere, mi rammarica d'altra parte che non ci sia il mio nome nella lista dei promotori, perché fra gli italiani che vi sono inscritti nessuno più di mé può avere quella stima scientifica, che ai di Lei talenti si compete, e nessuno più di mé può dire d'essere un seguace convinto di Ernesto Hæckel.

Probabilmente a qualche mio collega di Roma, io debbo l'essere stato appositamente trascurato. Mi perdoni, Illustre Professore, questo mio sfogo di dolore, ma non poteva non aprirLe l'animo mio in questa occasione sì solenne.

Accolga i sensi della mia piu alta stima, uni= /2/ tamente ai più cordiali augurj di prospera vita, così preziosa alla scienza ed alla umanità.

Suo devoto ed affezionato
Prof.^{e} Leopoldo Maggi.

Illustrious Prof. Haeckel.

Pavia, January 8th, 1894.

I have received an invitation to celebrate the sixtieth year of your life, and while this fills me with the greatest joy, I am on the other hand sad to see that my name has not been included in the list of the committee, as from the Italians who have been listed, there is no one who could have the degree of scientific esteem, which your talents are due, and no one could say more truly than I that he is a convinced disciple of Ernest Haeckel.

Probably, the fact that I have been passed over is due to some colleague of mine in Rome. Forgive me, illustrious professor, my outburst of pain, but I could not avoid opening my heart to you on such a solemn occasion.

Accept my feelings of highest esteem, together with my most cordial wishes for a prosperous life, which is so precious to science and to humanity.

Your devoted and affectionate Prof. Leopoldo Maggi.

300 The apostrophe is out of place here, but that conforms to Maggi's use in his printed works as well.

Pavia 22 Marzo 1894.

Illustre e carissimo Professore!

Le notizie che mi ha dato gentilmente della splendida riuscita del suo festeggiamento, mi hanno fatto un grandissimo piacere, ed io ne ho data pubblicazione sul giornale di quì; come ho già mandato allo stesso giornale la sua lettera di ringraziamento del 20 febbrajo p.p., tradotta in italiano, perché tutti conoscano come si possa stimare ed affezionarsi ad Ernesto Hæckel.

Godo della combinazione che mi ha detto riguardo all'argomento dei Muschi e loro popolazione microscopica.[301] Io l'ho dedicato a Lei per il modo con cui è trattato, volendo così ricordare che Ella è pure Maestro nel rendere popolare la scienza. La ringrazio de' suoi preziosissimi doni, e mé ancora carissimi per le sue benevoli dediche. L'avere il suo ritratto a 60 anni mi è una vera gioja ed auguro a Lei ed a mé un suo ritratto d'età molto avanzata. Le sue 20 illustrazioni dell'India, sono di piacevole osservazione anche della mia famiglia, /2/ avendo noi tutti letto il suo interessante viaggio.[302] Importante mi è Der Monismus.[303] Bello il pensiero del Speisen-Folge beim Fest-Essen[304] etc. Approfittando della sua cortese offerta, Le dirò che non ho Arabische Korallen.[305]

Quando verrà a Pavia, La prego di avvisarmi prima, perché io non possa perdere un minuto della Sua compagnia, tanto da mé sospirata.

Accolga i più cordiali saluti e ringraziamenti del sempre

Suo Devotissimo
Prof.[e] Leopoldo Maggi.

Pavia, March 22nd, 1894.

Illustrious and dearest Professor!

The notice of the splendid success of your celebration, which you have kindly given me, has filled me with greatest joy, and I have arranged for it to be published in the local newspaper; I had already sent to the same paper your letter

301 M212.

302 Haeckel's *Indische Reisebriefe. Mit dem Porträt des Reisenden und 20 Illustrationen* (1882) were published in a third edition in 1893.

303 *Der Monismus als Band zwischen Religion und Wissenschaft*. Bonn: Strauß, 1892.

304 The menu list was reproduced in 1993, on the occasion of a seminar, organised jointly by the *Istituto italiano per gli studi filosofici* and the *Stazione zoologica "Anton Dohrn"* in Naples, held at the *Palazzo Serra di Cassano* on 16 and 17 Nov. 1993. The delicacies include *Archaeopteryx* on *choucroute*, or *Gastraeads* on ice, and several other zoological specialties, complete with references to Haeckel's publications.

305 *Arabische Korallen*. Berlin: Reimer, 1876. Report of a cruise on the Red Sea. During part of the journey, Haeckel was in the company of Paolo Panceri.

of thanks of 20 February last, translated into Italian, so that all should know the esteem and affection felt for Ernest Haeckel.

I like the combination you told me about regarding the argument of the mosses and their microscopic inhabitants. I have dedicated it to you because of the way in which it has been treated, as a reminder that you are also a master of rendering science popular. I thank you for your most precious gifts, which are made even dearer to me by your benevolent dedications. Having a portrait of you at the age of sixty is a true joy for me, and I wish both you and me a portrait of you at a very advanced age. Your 20 illustrations from India are most pleasant to look at, also for my family, as we have all read about your interesting journey. Important for me is *Der Monismus*. A beautiful thought the *Speisen-Folge beim Fest-Essen* etc. Profiting from your kind offer, I may say that I do not have *Arabische Korallen*.

When you come to Pavia, please, let me know in advance, so I will not lose a single minute of your company, which I so much desire.

Accept my most cordial greetings and thanks, always

your most devoted Prof. Leopoldo Maggi

Illustre e carissimo Professore

Pavia 11 Aprile 1894.

La ringrazio immensamente dei doni nuovi (Arabische Korallen, Metagenesis und Hypogenesis von Aurelia aurita,[306] Perigenesis,[307] Ursprung etc. Gewebe,[308] tavole Monera e Leptomedusæ[309]), che gentilmente e generosamente mi ha fatto, e La prego di scusarmi del ritardo, dovuto agli esami della sessione straordinaria.

Metterò nella biblioteca del Laboratorio di Anatomia comparata, come suo dono, Perigenesis e Ursprung etc. Gewebe, avendole io di già.

Le mando i miei ultimi lavori, e sempre col desiderio di fare la sua conoscenza personale /2/ e di stare un po' di tempo insieme a discorrere, mi professo, coi più cordiali saluti,

Suo Devotiss[o].
Prof.[e] Leopoldo Maggi

Illustrious and dearest Professor

Pavia, April 11th, 1894.

I am immensely grateful for your new gifts (*Arabische Korallen*, *Metagenesis und Hypogenesis von Aurelia aurita*, *Perigenesis*, *Ursprung etc. Gewebe*, plates *Monera* and *Leptomedusae*), which you kindly and generously sent me, and I beg your forgiveness for the delay, which was due to exams of the extraordinary session.

I will place Perigenesis and Ursprung etc. Gewebe into the library of the laboratory of comparative anatomy as your donation, given that I already possess them.

I am sending you my latest works, and always with the desire to meet you in person and to spend a little time together in discussion, declare/profess myself, with the most cordial greetings, your most devoted Prof. Leopoldo Maggi

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306 Jena: Fischer, 1881.

307 *Die Perigenesis der Plastidule oder die Wellenzeugung der Lebenstheilchen*. Berlin: Reimer, 1876. In fact, Maggi had commented on this booklet while working on his plastidular theory before 1878.

308 'Ursprung und Entwicklung der thierischen Gewebe'. *Jenaische Zeitschrift für Naturwissenschaft* 18 (1884):206-275, also published separately by Fischer in Jena.

309 Unclear from which works; Medusae could be from the atlas *Das System der Medusen*. Jena: Fischer 1879-80.

Pavia 18 Giugno 1899.

Illustre Professore

Ho ricevuto il I° e II° fascicolo della sua magnifica opera: Kunstformen der Natur,[310] e mentre stava aspettandone il conto, ebbi l'avviso dell'Istituto bibliografico che la spedizione mi è fatta fare da Lei.

Io non ho parole per ringraziarLa di sì stupendo dono unitamente alla di Lei grande generosità verso di mé. Come Le sono tuttora, Le sarò grato per tutta la vita.

Giacché è tanto buono con mé, mi permetta una domanda. Soddisfano alla di Lei considerazione i miei lavori di craniogenia? Essi sono fatti colla scorta della legge che Ella ha chiamato biogenetica fondamentale. Ora sviluppo gli argomenti speciali, e se questi incontreranno l'approvazione degli anatomici, tratterò poi complessivamente, la morfologia del cranio. Il materiale non mi manca, avendo feti e diversi, posso dire, per ogni ordine di mammiferi, oltre che per le diverse classi di Vertebrati.

Accolga, illustre Professore, i miei più sentiti ringraziamenti ed i sensi della mia massima stima.

Suo Devotis.mo.
Prof.e Leopoldo Maggi.

Pavia, June 18th, 1899.

Illustrious Professor

I have received the Ist and IInd fascicle of your magnificent work: *Kunstformen der Natur*, and while I was waiting for the account, I received a note from the Bibliographic Institute[311] saying that the despatch had been commissioned by you.

I have no words to thank you for such a stupendous gift, together with your great generosity towards me. As I already am, so I will be grateful to you all my life.

Given that you are so good to me, will you permit me a question? In your opinion, are my works in craniogeny satisfactory? They have been made in the wake of the law which you have called the fundamental biogenetic law. For now, I am developing the specific arguments, and if those will meet with the anatomists' approval, I will treat the morphology of the skull comprehensively. There is no lack of material, as I have fetuses, several I may say, for each order of mammals, in addition to the various classes of vertebrates.

Accept, illustrious Professor, my most heartfelt thanks and my feelings of greatest esteem. Yours most devoted Prof. Leopoldo Maggi.

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310 published in instalments, 1899-1904, by Bibliographisches Institut, Leipzig.
311 i.e., the Bibliographisches Institut, Leipzig.

Pavia 9 Dic. 1903.

Illustre Professore

Sapendo, dal mio allievo Prof. Giacomo Cattaneo, che Ella si trova a Rapallo, Le invio costì le mie parole lette all'Istituto Lombardo in morte di Carlo Gegenbaur.[312]

Ma io Le debbo dire che, sentendo vivissimo il desiderio di fare la sua conoscenza personale, non voglio lasciarmi sfuggire questa occasione propizia di sua presenza da noi per visitarla.

Ed io verrei qualora conoscessi i suoi giorni possibili di ricevimento.

Coi sensi della più alta stima, mi raffermo

Suo Devotis[mo]
Prof.[e] Leopoldo Maggi.

Pavia, December 9th, 1903.

Illustrious Professor

Having learnt from my former student, Prof. Giacomo Cattaneo, that you are currently to be found in Rapallo, I am sending you there my words read at the Istituto Lombardo on the occasion of Charles Gegenbaur's death.

But I have to tell you that, given my most lively desire to meet you in person, I do not want to miss this propitious chance of your presence in our area to visit you.

And I would come whenever I might know your possible days of receiving me.

With feelings of the highest esteem, I declare myself
Yours most devoted Prof. Leopoldo Maggi

biglietto di visita senza data
stampata: Prof.[e] Leopoldo Maggi
R. Università di Pavia
a mano: il vecchio amico mai visto, e che ora si fà vedere con grande piacere

Carte de visite, no date. Imprint: Prof. Leopoldo Maggi, Royal University of Pavia

handwritten: the old friend never seen, and who now will present himself with great pleasure

312 M278.

Pavia 25 Dic. 1903.

Mio caro Professore ed amatissimo Maestro

Ancora, grazie tante della cordialissima accoglienza fattami insieme alla sua gentilissima Signora.

Le parti dei due giorni passate presso di Lei, furono di gaudio immenso per il mio cuore e la mia mente, e mi rimarranno impresse per tutta la mia vita.

D'ora in avanti leggendo i suoi autorevoli lavori scientifici, mi parrà di sentire la sua viva voce e di vedermi sempre presente la simpatica sua figura.

Teniamo ferme le nostre vicendevoli promesse.

La mia Signora contraccambia alla sua Signora ed a Lei i suoi distinti rispetti, col desiderio di conoscerli personalmente. Ed io pure La prego /2/ di presentare alla Signora i miei doveri e saluti.

A Lei una cordialissima stretta di mano dal

Suo Devots. ed affez.º
Prof. Leopoldo Maggi.

Pavia, December 25th, 1903.

My dear Professor and most beloved Master

Again, many thanks for the most cordial welcome you have prepared for me, together with your most gentle Signora.

Those parts of the two days spent with you brought great joy to my heart and my mind, and will remain impressed upon me for all my life.

Let us firmly keep our mutual promises.

My Signora reciprocates with your Signora and you her distinguished respect, with the desire to meet both of you personally. And I, too, pray you to extend to your Signora my obligations and greetings.

To you a most cordial handshake from

your most devoted and affectionate Prof. Leopoldo Maggi

Pavia 14. febb. 1904.

Illustre Maestro ed amico carissimo

Le porgo, unitamente a mia moglie, le felicitazioni pel suo 70° anno di vita così gloriosamente trascorsa,[313] e gli augurj per una sua lunga durata, sempre in sostegno del libero pensiero, della libera scienza e della libertà d'insegnamento. Possa la dottrina dell'evoluzione, da Lei sistematizzata, continuare vittoriosa!

Le mandiamo, qual segno della sua festa, in data 16 corr., il ritratto e la biografia[314] del naturalista Prof.^{e} Balsamo-Crivelli, padre di mia moglie e mio primo maestro.

La preghiamo di aggradire i sensi della nostra stima e di riverirci distintamente la sua Signora. Speranzoso di vederLi a Pavia, Le stringo sentitamente la mano.

Suo Devotis.^{mo} ed aff.^{mo}
Prof.^{e} Leopoldo Maggi.

Pavia, February 14th, 1904.

Illustrious Master and dearest friend

I, together with my wife, send you felicitations for the 70th year of a life spent so gloriously, and best wishes for a long lifetime, always in support of free thought, free science, and freedom in teaching. May the doctrine of evolution, which you have systematised, continue victoriously!

We are sending you, as a token for your celebration, on the 16th inst., the portrait and the biography of the naturalist Prof. Balsamo Crivelli, father of my wife and my first teacher.

We beg you to accept our feelings of esteem and to forward our sincere greetings to your Signora.

Hoping to see both of you in Pavia, I warmly shake Your hand.

Your most devoted and affectionate Prof. Leopoldo Maggi

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313 On the occasion of Haeckel's seventeenth birthday, a banquet had been organised in Genoa a month earlier (14 January, 1904).

314 I am not aware of a biography other than the necrology by Taramelli (1883); RBr.



Fig. 9: Banquet on the occasion of Ernst Haeckel's seventieth birthday[315]

[316]Pavia 6 Aprile 1904.

[Maggi][317]
Illustre Professore e caro amico

La ringrazio tanto delle sue notizie e della speranza che mi fa avere ancora di vederLa quì in Pavia, se però non Le è di troppo disturbo. Se saprò il giorno e l'ora del Loro[318] arrivo, verrò io a prenderLi alla stazione e Li condurrò all'albergo, in mancanza d'una mia stanza adatta per Loro, stando però sempre insieme, giacché li desidero quì come se fossero in casa mia privatamente.

Ho avuto una sua cartolina con un segue lettera, come pure ebbi il suo libro: I problemi dell'Universo,[319] che lo ricevette anche il Prof. Monti. Sapendo che Lei era partito da Rapallo e non dove era andato, io ho mandato un biglietto di

315 The event was held at the Hotel Bristol. Maggi is sitting to the left of Haeckel, surrounded by a good dozen of colleagues, among whom there are several of Maggi's former students, including Corrado Parona, Giacomo Cattaneo, the siblings Achille and Rina Monti, and Angelo Andres. Photo and guest list of the event have been reproduced in CISST (ed., 1993), pp. 80&77, respectively.

316 Underscored (probably by Haeckel).

317 Underscored (probably by Haeckel).

318 Emendated from *loro*.

319 *I problemi dell'universo*, transl. by Amedeo Herlitzka. Turin: UTET, 1904 (orig.: *Die Welträthsel.* Bonn: Strauß, 1899).

ringraziamento per Lei alla Tipografia editrice [sic][320] di Torino, colla preghiera del ricapito. - Ora sono ben contento di poterLe dirigere direttamente i miei sentiti ringraziamenti pel prezioso dono fattomi. - Godo che abbia finito il suo /2/ lavoro sui problemi della biologia generale, e mi auguro che venga anch'esso tradotto in italiano, perché ne possa essere diffusa la lettura anche da noi.

I suoi scritti fanno sempre pensare e pensar bene per la scienza e l'umanità.

Accolga tanti saluti per Lei e la sua Signora, anche da parte della mia Signora, e mi creda cordialmente sempre il Suo

Devotiss.^{m} ed affezion.^{mo}
Prof. Leopoldo Maggi.

P.S. I Monti[321] sono ancora a Roma

Pavia, April 6th, 1904.

Illustrious Professor and dear friend

I thank you for your news and for the hope you are giving me to see you again here in Pavia, if that is not too much trouble for you. If I know the day and time of your arrival, I will come and take you from the station and conduct you to the hotel, lacking an adequate room for you at my place, but we will stay together all the time, as I would like you to be here as if you were staying in my home privately.

I have received a postcard from you with a "letter follows" note, as I also received your book: The Riddle of the Universe,[322] which Prof. Monti also received. As I knew that you had left Rapallo, but did not know where you had gone, I have sent a letter of thanks to you to the Typography Editor in Turin, with the request that it be forwarded. – Now I am very content to be able to address my warmest thanks for your precious gift directly to you. – I am happy to know that you have completed your work on the problems of general biology, and I hope that it will be translated into Italian as well, so it will be widely read in our country, too.

Your writings always provoke thought, and to think well for science and humanity.

Accept many greetings for yourself and your Signora, also on behalf of my Signora, and believe me to be cordially always your most devoted and affectionate Prof. Leopoldo Maggi

P.S.: The Montis are still in Rome

320 Unione Tipografico-Editrice Torinese (UTET).

321 Presumably, Maggi's students, the siblings Achille and Rina Monti. On the latter, see Dröscher (2007).

322 Incidentally, the English title (transl. by Joseph McCabe) is misleading, as the original refers to the (seven) "riddles of the universe" postulated by the positivist physiologist Emil du Bois-Reymond (1881). Herlitzka's Italian translation (1904) correctly uses the plural form.

Pavia 27. Nov. 1904.

Illustre Professore ed amico carissimo

Ritornato dalla campagna, trovo sul mio tavolo il suo bellissimo ed importante libro: Die Lebenswunder,[323] ch'Ella ha voluto donarmi, secondo la sua solita cortesia, e che io leggerò attentamente, come faccio sempre delle opere del mio insigne Maestro. Pertanto mille grazie di tutto cuore delle Meraviglie della Vita.

Sarei venuto volontieri al Congresso del libero pensiero in Roma,[324] se mi fossi sentito bene, così ho dovuto con dispiacere rinunciarvi.

Io non ho perduto le speranze di verderLa quì a visitare il mio nuovo Istituto di Anatomia e fisiologia comparate e di Protistologia, separato da quello di Zoologia sistematica.

Se io saprò dove Ella passerà quest'inverno in riviera, mi procurerò il piacere di venire a trovarLa.

Accolga, colla massima stima, i miei cordiali saluti.

Suo Devotis. Affez.º
Prof. Leopoldo Maggi.

Pavia, Nov. 27th, 1904.

Illustrious Professor and dearest friend

On my return from the countryside, I find on my table your beautiful and important book: Die Lebenswunder, which you have decided to give to me, according to your usual courtesy, and which I will read attentively, as I always do with the works of my famous Master. Thus, a thousand thanks from all my heart for the Wonders of Life.

I would have liked to attend the Free Thought Congress in Rome, if I had been feeling well, but as it was, I have had to back out, with displeasure.

I have not given up on the hope to see you here visiting my new Institute of Comparative anatomy and physiology and of Protistology, independent from that of Systematic zoology.

If I find out where you are going to spend this winter in the Riviera, I will give myself the pleasure to visit you.

Accept, with my greatest esteem, my most cordial greetings,

your most devoted affectionate Prof. Leopoldo Maggi

323 Stuttgart: Kröner, 1904.

324 Proceedings: Associazione internazionale del libero pensiero (n.d. [ca. 1905]).

Appendix 2: List of Leopoldo Maggi's publications in chronological order

Abbreviations and notes:

- *Rend²*= Rendiconti del R. Istituto Lombardo di scienze e lettere, 2nd series. Milan
- *Atti Soc. it. = Atti della Società italiana di scienze naturali.*
- *Boll. sc. = Bollettino scientifico (Pavia)*
- Order and numbers of the entries as in Maggi's copy of M272, reproduced in Armocida et al. (2002):107-124, updated following Maggi's handwritten additions on the copy held at the *Istituto di anatomia e fisiologia comparate*, University of Pavia. Intercalated additions by Maggi are marked in superscript (X^{bis}), those added by the present author with a lowercase letter (Xb).
- *not available*: marked as *esaurito* in Maggi's bibliography, missing in his bound paper volumes.
- Page numbers have been added, as far as this present author has been able to retrieve the original journal issues.
- *offprint*: consulted only repaginated offprint version in Maggi's bound papers (at the library of the Istituto di Anatomia e Fisiologia Comparate, Palazzo Botta, Pavia), hence original page numbers not available.

Nulla dies sine linea.[325]

1863

1. Sull'apparecchio circolatorio degli animali (thesis in natural sciences). Milan: Lombardi
2. Delle degenerazioni (thesis in medicine). Pavia: Fusi

1864

3. Intorno allo studio della mineralogia e geologia. Lecture for the course on mineralogy and geology at Pavia University (no copies available)

1865

4. Intorno al genere Aeolosoma (= *Memorie della Società Italiana di Scienze Naturali* vol. 1 no. 9), 17 pp., 2 plates.

1866

5. 'Intorno al terreno erratico della Valcuvia'. *Atti della Società Italiana di Scienze Naturali* 9: 35-49.

1867

6. 'Sulla produzione di alcuni organismi inferiori' (with Balsamo). Memorie del R. Istituto Lombardo di scienze, lettere ed arti 10 (= 3rd ser., vol. 1), no. 16/2.

6.b 'Sulla produzione di alcuni organismi inferiori' (with Balsamo). R*endiconti del R. Istituto Lombardo di scienze, lettere ed arti, Classe di scienze mediche e naturali* 4:171-174.

7. 'Sulla produzione di alcuni organismi inferiori in presenza dell'acido fenico' (with Balsamo). *Rendiconti* 4: 354-368.
8. 'Ancora sulla produzione degli infusorj in liquidi bolliti' (only Giovanni Cantoni listed as author!). *Rendiconti* 4: 201, 274-291, also in *Nuovo Cimento* Nov/Dec. 1867.

1868

9. 'Intorno alla produzione del Leptothrix' (with Balsamo). *Rend*[2] 1:51-56.
10. 'Sulla produzione del Bacterium termo Duj. e del Vibrio Bacillus Duj. (with Balsamo). *Rend*[2] 1:288-303.

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325 "Not a day without [producing at least] a line" was a common, though apocryphal motto, which Maggi used as epigraph on his printed publication lists, e.g., M272. Pliny the Elder (23-79) attributes this line to the painter Apelles (fl. 4th century BC), though not quite literally: "Also, Apelles had the permanent habit not to pass even the busiest day without practising his art by drawing at least a line, which from then on became a proverbial expression." ("*Apelli fuit alioqui perpetua consuetudo numquam tam occupatum diem agendi, ut non lineam ducendo exerceret artem, quod ab eo in proverbium venit*"). *Naturalis Historia* 35.84.

11. 'Sulla derivazione del Bacterium termo Duj. e del Vibrio bacillus Duj. dai granuli vitellini dell'ovo di pollo (with Balsamo). *Rend*^{2} 1:399-406.
12. 'La produzione di alcuni esseri inferiori'. *La Posta del mattino* [daily newspaper, Milan] (not available).
13. 'Intorno alle cellule del fermento (Hefezellen)' (with Balsamo). *Memorie del R. Istituto Lombardo di Scienze e Lettere* 11 (= 3rd ser., vol. 2), no. 6.
14. 'Intorno alle cellule del fermento (Hefezellen)' (with Balsamo). Summary of M13. *Rend*^{2} 1: 563-568.

1869

15. 'Intorno ai depositi lacustro-glaciali ed in particolare di quelli della Valcuvia'. *Memorie del R. Istituto Lombardo di Scienze e Lettere* 11 (= 3rd ser., vol. 2), no. 8; summary in Rend^2 2:41-43.
16. 'Intorno al conglomerato dell'Adda'. *Rend*^{2} 2:733-740.
17. 'Alcuni cenni sovra lo studio dei corpi frangiati delle rane' (with Balsamo). *Rend*^{2} 2:716-718.
18. 'Sulla coltivazione delle forme mieliniche' (with Balsamo). *Rend*^{2} 2:952-954.
19. 'Ancora sulla produzione degli infusorj in palloncini suggellati ermeticamente e scaldati oltre i 100°' [only Cantoni listed as author]. *Rend*^{2} 2:1123-1124, 1131-1135.
20. 'Sulla corrispondenza fra la larghezza del Vibrio-bacillus ed il diametro degli elementi morfologici da cui derivano'. *Rend*^{2} 2:1208-1212.

1870

21. 'Di una abitazione lacustre in Valcuvia'. *Rend*^{2} 3:221-223.
22. 'Sull'esistenza dell'uomo nell'epoca terziaria'. *Rend*^{2} 3:223-230.
23. 'Sulla produzione delle muffe entro palloncini di vetro, chiusi a fuoco e scaldati a 150°C' (with Balsamo and Cantoni). *Rend*^{2} 3:562-563.
24. 'Sulla produzione delle Amibe' (with Balsamo). *Rend*^{2} 3:367-375.
25. 'Sulla produzione delle muffe entro palloncini di vetro, chiusi a fuoco e scaldati a 150°C. Seconda comunicazione' (with Balsamo). *Rend*^{2} 3:807-812.
26. 'Altra prova sperimentale sulla derivazione del Vibrio bacillus nelle soluzioni di tuorlo d'ovo di pollo, dalle granulazioni vitelline grasse' (with Balsamo). *Rend*^{2} 3:812-814.

1871

27. 'Ancora sulla produzione delle Amibe' (with Balsamo). *Rend*^{2} 4:198-203.

28. 'Sull'analisi chimica delle rocce fatte dal signor Kosmann sotto il punto di vista dei loro principj assorbibili dai vegetali'. Review in *Bollettino del Comizio Agrario di Pavia* (not available).
29. 'Intorno ad alcuni oggetti d'industria umana preistorica trovati nelle tombe di Malgesso presso Gavirate'. *Cronaca Varesina* (newspaper) 6 nos 52, 24 December.

1872

30. 'Intorno agli organi essenziali della riproduzione delle anguille, alle particolarità anatomiche del loro apparecchio genito-urinario ed alla forma delle loro intestina, come carattere specifico' (with Balsamo). *Memorie del R. Istituto Lombardo di Scienze e Lettere* 12 (= 3rd ser., vol. 3): 229-240, 1 plate.
31. 'Intorno agli organi essenziali della riproduzione delle anguille, alle particolarità anatomiche del loro apparecchio genito-urinario ed alla forma delle loro intestina, come carattere specifico' (with Balsamo), summary. *Rend*[2] 5:20-22.
32. 'Sopra alcuni antichi oggetti di bronzo trovati in Valcuvia'. *Cronaca Varesina* (not available).
33. 'Sopra alcuni teschi umani trovati a Casteggio (Vogherese) in tombe d'epoca romana'. *Atti Soc. It.* 15:100-105.
34. 'Prelezione al corso libero di Eterogenia sperimentale dato nella R. Università di Pavia nel 1871'. *Gazzetta Medica Italiana. Lombardia* 32 (= 6th series, vol. 5, no. 23):181-187.
35. 'Sopra alcuni teschi umani trovati a Casteggio (Vogherese) in tombe d'epoca Romana'. *Atti Soc. it.* 15:137-142.
36. 'Intorno ad una cuspide di freccia in selce trovata nel sabbione di Carbonara (dintorni di Pavia)'. *Atti Soc. it.* 15:143-145.
37. Del modo di fare la raccolta lito-tecnologica. *Cronaca Varesina* (not available).

1873

38. 'Ancora di alcune esperienze con infusioni organiche, chiuse a fuoco in palloncini di vetro scaldati a 150°C'. (with Balsamo). *Rend*[2] 6:23-26.
39. Carta geologica della Valcuvia, in scala di 1/50.000 in due fogli presentata all'esposizione tenutasi in Varese nell'anno 1871 (unique copy donated to Museo Patrio di Varese, no longer extant).

1874

40. 'Cuspide di lancia in bronzo (- Cuspide del lago di Varese)'. *Cronaca Varesina* 9.5+6, also in *Memorie della Società del Museo Patrio di Varese* 1).
41. 'Sopra alcune tombe antiche trovate a Cuvio (Valcuvia)'. *Cronaca Varesina* (not available).

42. 'Sopra alcune tombe antiche trovate in Valmarchirolo'. *Cronaca Varesina* (not available).
43. 'Sulla geognosia del Sasso Meraro in Valcuvia'. *Rend*^{2} 7:58-66.
44. '[Cenni] sulla costituzione geologica del territorio di Varese', in Bizzozero, Giulio Cesare: *Guida descrittiva di Varese e suo territorio*. Varese: Ubicini, pp. 9-46.
45. *Sulla storia naturale degli esseri inferiori (Infusorj)*. Milan: Bernardoni.
46. 'Sulle distinzioni introdotte nella generazione spontanea'. *Rend*^{2} 7:488-493.
47. 'Descrizione di un nido singolare della formica fuligginosa'. *Atti Soc. it.* 17:64-98, plates 3-6.
48. '[Nuove osservazioni] sull'architettura delle formiche'. *Rend*^{2} 7:86-89.
49. 'Cranio umano dell'epoca del bronzo, trovato in Valcuvia'. *Cronaca Varesina* 9.20-24, 28-30, 34, 44-45, 48 (also in *Memorie della Società del Museo Patrio di Varese* 1, 3 plates.

1875

50. 'Nuova serie di esperimenti su l'Eterogenia e conclusioni tratte da altre serie precedenti' (with Cantoni). *Rend*^{2} 8:94-101.
51. 'Sulla produzione delle Autamebe in relazione colla nuova teoria dei plastidi e coll'eterogenia'. *Gazzetta Medica Italiana. Lombardia* 35: 73-76.
52. 'Sull'Urocentrum turbo Ehr.' *Rend*^{2} 8:37-42.
53. *Primo elenco degli infusori della Lanca di S. Lanfranco presso Pavia*. Pavia: Succ. Bizzoni.
54. 'Intorno ai nidi della formica fuliginosa Latr.' *Atti Soc. it.* 18:83-91.
55. 'Intorno all'apparecchio biliare dell'Haliætus albicilla Bp.' *Rend*^{2} 8:15-20.
56. *Avvertenze agli studi fatti nel Laboratorio di Storia Naturale della R. Università di Pavia*. Pavia: Succ. Bizzoni.

1876

57. 'Altre serie di esperienze sull'archebiosi' (with Cantoni). *Rend*^{2} 9:630-634.
58. 'Sulla coniugazione o Zigosi delle Amibe'. *Rend*^{2} 9:436-444.
59. 'Intorno ai Rizopodi d'acqua dolce della Lombardia ed in particolare del Podostoma filigerum Clap. e Lach.' *Rend*^{2} 9:538-550, 1 plate.
60. 'Studi anatomo-fisiologici intorno alle Amibe ed in particolare di una innominata'. *Atti Soc. it.* 19:399-451, plate 9.
61. 'Intorno alla comparsa del nucleolo nello sviluppo di alcuni protozoi'. *Rend*^{2} 9:502-508.
62. 'Ricerche di alcuni infusori Ciliati nella Valcuvia'. *Atti Soc. it.* 29 offprint.
63. *Intorno agli Infusori di Milano*. Varese: Ferri.

64. 'La mielina nella diffluenza degli Infusorj'. *Rend*^{2} 9:508-514.
65. *Avvertenze agli studi fatti nei laboratori di Zoologia ed Anatomia Comparata (dal 1 Giugno 1875 alla fine Dicembre 1875) e di Anatomia e Fisiologia comparate (dal 1 Gennaio 1876 alla fine Dicembre 1876).* Pavia: Succ. Bizzoni.

1877

66. 'Ricerche sperimentali su l'Eterogenesi' (with Cantoni). *Rend*^{2} 10:297-303.
67. 'Ricerche sperimentali su l'Eterogenesi. 2nd Communication' (with Cantoni). *Rend*^{2} 10:352-360.
68. 'Sulla esistenza dei moneri in Italia'. *Rend*^{2} 10:360-361.
69. 'Contribuzione alla morfologia delle Amphizonelle'. *Rend*^{2} 10:315-323.
70. 'Sulla natura morfologica dei Distigma'. *Rend*^{2} 10:261-266.
71. 'Intorno all'incistamento del Proteo di Guanzati (Amphileptus moniliger Ehr. di Clap. e Lach.)'. *Rend*^{2} 10:227-234.
72. *Sui protozoi dell'Italia* (1st part). Pavia: Bizzoni (collection containing papers M68, 51, 58, 59, 60, 69, 61, 70, 53, 62, 63, 52, 71, 64).
73. *Avvertenze agli studi fatti nel laboratorio di Anatomia e Fisiologia comparate 3*. Pavia: Succ. Bizzoni.

1878

74. 'Ricerche sperimentali su l'Eterogenesi (Sul limite di produttività delle soluzioni organiche) 3rd Communication' (with Cantoni). *Rend*^{2} 11:40-47.
75. 'Sugli studi di C. Parona e G. B. Grassi intorno all'Anchilostoma duodenale Dub.' *Rend*^{2} 11:428-436.
76. 'Contribuzione al catalogo dei Rizopodi d'acqua dolce della Lombardia e loro distribuzione secondo la classificazione di Hertwig e Lesser modificata da Archer.' *Atti Soc. it.* 21:313-319.
77. 'Di un cranio umano trovato nella grotta del Tufo di Valgana.' *Atti Soc. it.* 21:308-312.
78. 'Intorno alle condizioni naturali del territorio Varesino.' *Atti Soc. it.* 21:273-300.
79. 'Catalogo delle Rocce della Valcuvia.' *Atti Soc. it.* 21:858-876.
80. 'Di alcune tombe della Valcuvia e della Valmarchirolo, appartenenti alla prima età del ferro.' *Atti Soc. it.* 21:439-447.
81. 'Intorno ad alcuni oggetti d'industria umana preistorica trovati nelle tombe di Malmesso presso Gavirate.' *Atti Soc. it.* 21: 435-438.
82. 'Sullo sbocco delle vene polmonali nella rana.' *Atti Soc. it.* 21: 468-474.
83. 'Sull'apertura del foro del Botallo, nel cuore degli uccelli a completo sviluppo.' *Atti Soc. it.* 21:474-476.

84. 'I plastiduli nei Ciliati, ed i plastiduli liberamente viventi.' *Atti Soc. it.* 21:326-330.

85. 'Sulla disposizione regolare del protoplasma, anteriormente alla formazione di microrganismi.' *Atti Soc. it.* 21:817-821, plate 16.

86. 'Primo elenco dei Rotiferi o Sistolidi della Valcuvia.' *Atti Soc. it.* 21:320-325.

87. *Avvertenze agli studi fatti nel laboratorio di Anatomia e Fisiologia Comparate 4*. Pavia: Succ. Bizzoni.

1879

88. 'Intorno alle Cothurnie parassite delle branchie dei gamberi nostrali'. *Rend*^{2} 12:439-448.

89. 'Sopra una varietà della Cothurnia pixidiformis d'Udek'. *Boll. sc.* 1:69-70.

90. 'Corso di Protistologia medica'. *Boll. sc.* 1:78-79.

91. 'Della primitiva origine degli organi'. *Boll. sc.* 1:76-78.

92. 'Sulle emiterie aritmetiche.' *Rend*^{2} 12:298-306.

93. 'Uno scheletro di Gorilla donato dal R. Collegio Ghislieri al Museo di Anatomia e Fisiologia Comparate'. *Il Patriotta* (daily newspaper, Pavia) no. 144, 2 December.

94. 'La morfologia'. *Boll. sc.* 1:1-4.

95. *Avvertenze agli studi fatti nel laboratorio di Anatomia e Fisiologia Comparate 5*. Pavia: Succ. Bizzoni.

96. Various short notes: Stabilimenti scientifici, Comunicazioni dai laboratori. *Boll. sc.* 1.

1880

97. 'Concetto dell'Anatomia e Fisiologia comparate, riguardate come una sola scienza'. *Boll. sc.* 1:85-87.

98. 'Intorno all'importanza medico-chirurgica dei Protisti'. *Boll. sc.* 1:89-91.

99. 'Una nuova amibina'. *Boll. sc.* 1:108-109.

100. 'Una nuova Nuclearia. – Descrizione e considerazioni intorno al suo posto nella sistematica, ed alla sua importanza nell'ontogenia animale'. *Rend*^{2} 13:729-734.

101. 'Il mesoplasma negli esseri unicellulari'. *Boll. sc.* 1:81-83.

102. 'Sulla Trichamœba irta De Fromentel et M. Jobard-Muteau'. *Rend*^{2} 13:39-47.

103. 'Intorno al Ceratium furca Clap. e Lach. e ad una sua varietà'. *Boll. sc.* 1: 125-128.

104. 'Intorno ai Cilio-flagellati. Nota corologica'. *Rend*^{2} 13:308-327.

105. 'Tassonomia e corologia dei Cilio-flagellati'. *Boll. sc.* 2:7-16.

106. 'Esame protistologico delle acque di alcuni laghi italiani'. *Boll. sc.* 2:33-43.

107. 'Osservazioni intorno alle deliberazioni del Consorzio Universitario di Pavia, riferentisi al Museo di Anatomia e Fisiologia Comparate'. *Boll. sc.* 2:61-63.

108. Various short notes: Museo di Anatomia, Stabilimenti Scientifici, Necessità di locali, Pubblicazioni scientifiche, Laboratorio di Zoologia marittima. *Boll. sc.* 2.

1881

109. 'Intorno ai Protisti ed alla loro classificazione'. *Boll. sc.* 2:16-23 + 107-121, 3:48-56.

110. 'Primo esame protistologico dell'acqua del lago di Loppio (Trentino)'. *Boll. sc.* 3:57-61.

111. 'Gli invisibili del Varesotto'. *Boll. sc.* 3:91-95.

112. 'I protisti e le acque potabili.' *Boll. sc.* 3:79-91.

113. 'Sull'analisi protistologica delle acque potabili'. *Rend*^{2} 14:621-626, also in *Boll. sc.* 4:121-125.

114. 'Mostruosità di un gambero d'acqua dolce (Astacus fluviatilis)'. *Rend*^{2} 14:333-342.

115. 'Anomalie di un pappagallo (Psittacus amazonicus Lin.)'. *Rend*^{2} 14:516-521.

116. 'Programma del corso di Anatomia e Fisiologia comparate dato nell'anno scolastico 1880-1881'. *Boll. sc.* 3:62-64.

117. *Avvertenze agli studi fatti nel laboratorio di Anatomia e Fisiologia Comparate 6-7*. Pavia: Succ. Bizzoni.

118. Various short notes: Trichina, Filossera, Peronospora; Bacteri nel tunnel del Gottardo, Mostruosità di un gambero (sunto), nomine, nuova nuclearia. *Boll. sc.* 3.

1882

119. 'Le idee di Hæckel intorno alla morfologia dell'anima'. *Rivista di filosofia scientifica* 1:436-445.

120. 'Sull'Acromasia degli Afaneri'. *Rend*^{2} 15:118-121.

121. *Protistologia*. Manuali Hoepli 34. Milan: Hoepli.

122. 'Esame protistologico dell'acqua del lago di Toblino (Tirolo Italiano)'. *Boll. sc.* 4:18-22.

123. 'Il Gozzo sotto il punto di vista protistologico, ossia le ricerche di Klebs intorno alle cause del Gozzo'. *Gazzetta medica italiana. Lombardia* 42 (8th ser. 4.2):14-15, 24-26.

124. 'Sull'analisi protistologica dell'acqua del lago Maggiore estratta a 60 metri di profondità, tra Angera ed Arona'. *Rend*[2] 15:326-345.

125. 'I fermenti fisiologici e le azioni chimiche negli organismi viventi'. *Boll. sc.* 4:30-31.

126. 'I protisti e l'economia politica'. *Boll. sc.* 4:86-87.

127. 'Protisti e malattie'. *Gazzetta medica italiana. Lombardia* 42 (8th ser. 4.48):483-485, 493-495.

128. Various short notes: Anomalie (sunto), necrologio Ippolito Macagno, Scuola d'applicazione di sanità militare, nomine. *Boll. sc.* 3+4.

1883

129. 'Glie ed acque potabili'. *Rend*[2] 16:421-430.

130. 'Intorno ad alcuni microrganismi patologici delle Trottelle'. *Boll. sc.* 5:18-22.

131. 'Intorno alle esperienze di vaccinazione carbonchiosa eseguite nella provincia di Pavia'. *Gazzetta medica italiana. Lombardia* 43.5: 55-57.

132. 'Applicazione di alcuni concetti morfologici dell'organizzazione animale alla medicina'. *Gazzetta medica italiana. Lombardia* 43.28:277-281.

133. 'Casistica per l'analisi microscopica delle acque potabili'. *Rend*[2] 16:759-776.

134. *Sull'analisi microscopica di alcune acque potabili della città e per la città di Padova*. Pavia: Succ. Bizzoni.

135. 'Sull'analisi microscopica dell'acqua delle sorgenti chiamate fontanili di fontaniva nel Padovano'. *Boll. sc.* 5:72-83.

136. 'Per la tecnica protistologica (Cloruro di palladio)'. *Boll. sc.* 5 (not available).

137. 'Ricerca di nitrati al microscopio'. *Boll. sc.* 5 (not available).

138. Various short notes: Cattedra e stabilimento di Zoologia. *Boll. sc.* 5.

139. 'Nuovi orizzonti della Protistologia medica'. *Gazzetta medica italiana. Lombardia* 44 (8th ser. 6.4-5):33-34, 44-48.

140. 'Commemorazione del Prof. Emilio Cornalia'. *Rend*[2] 17:42-55, 106-155.

1884

141. 'Sull'importanza scientifica e tecnologica dell'esame microscopico delle nostre acque di Pavia'. *Boll. sc.* 6:59-62.

142. 'Sul numero delle prove d'esame per l'analisi microscopica delle acque potabili e sul tempo per ciascuno di esse'. *Boll. sc.* 6:121-123.

143. 'Sull'influenza d'alte temperature nello sviluppo dei microbi'. *Boll. sc.* 6:77-115, table.

144. Various short notes: Nomine. *Boll. sc.* 6.

1885

145. 'A proposito dei protisti cholerigeni'. *Gazzetta medica italiana. Lombardia* 45 (8th ser. 6):82-84, 85-90, 102-103.
146. 'Cenno risguardante la presentazione della sua nota: Sull'influenza d'alta temperatura nello sviluppo dei microbi'. *Rend*[2] 17:837-841.
147. 'Sull'analogia delle forme del Kommabacillus Koch con quelle dello Spirillum tenue Ehr. osservata da Warming'. *Rend*[2] 18:267-268.
148. 'Intorno alle ricerche di Pacini riguardanti i Protisti cholerigeni'. *Boll. sc.* 7:4-14, 36-46.
149. 'Intorno ai protisti cholerigeni osservati dal Pacini'. *Rend*[2] 18:432-440.
150. 'Sulla distinzione morfologica degli organi negli animali'. *Rend*[2] 18:481-491.
151. 'Di alcune funzioni degli esseri inferiori a contribuzione della morfologia dei Metazoi'. *Rend*[2] 18:636-648.
152. 'Per l'analisi microscopica delle acque'. *Boll. sc.* 7:55-59.
153. 'La priorità della batterioterapia'. *Rend*[2] 18:877-879.
154. 'Settimo programma d'Anatomia e Fisiologia comparate coll'indirizzo morfologico, svolto all'Università di Pavia, nell'anno 1883-84'. *Boll. sc.* 7:104-119.
155. 'Saggio d'una classificazione protistologica degli esseri fermenti'. *Boll. sc.* 7:69-87.
156. Various short notes: Sull'analisi fatta dal Dr. Girard, di una nota del signor Hommel di Zurigo sul colera; sunti: Sulla distinzione morfologica degli organi; Di alcune funzioni degli esseri inferiori a contribuzione, La priorità, Nuovo regolamento universitario, Società medico chirurgica di Pavia; Saggio d'una classificazione protistologica degli esseri fermenti. *Boll. sc.* 7.

1886

157. 'Il suo a ciascheduno. Prelezione al corso di Protistologia (Anno 1885-86)'. *Gazzetta medica italiana. Lombardia* 46:65-68, 112-114
158. 'Questioni di nomenclatura protistologica'. *Boll. sc.* 8:17-22.
159. 'Per dare un'idea delle forme degli infinitamente piccoli, senza microscopio e senza disegni'. *Boll. sc.* 8:56-61.
160. *I piccoli benefattori dell'umanità*. Milan: Dumolard.
161. *Protisti ed alcaloidi*. Milan: Rechiedei (orig. in *Gazzetta medica italiana. Lombardia*).
162. 'Temi di protistologia medica trattati nei corsi liberi, con effetti legali, all'Università di Pavia negli otto anni scolastici, dal 1878-79 al 1885-86'. *Boll. sc.* 8:99-105.

163. 'Di alcune soluzioni di colture e loro sterilizzazioni'. *Rend*^{2} 19:850-855.

164. Various short notes: Rivista Varigny: Di un metodo per la determinazione degli alimenti di un dato microbio; Varigny: Sull'attenuazione dei virus; nuovo regolamento delle Biblioteche; Varigny: Microbi patogeni e immunità; Stokvis: Sull'azione chimica dei Microbj; Acquisto del Palazzo Botta-Cusani. *Boll. sc.* 8.

1887

165. 'Intorno ad alcuni metodi di coltura delle acque potabili'. *Rend*^{2} 20:260-263.

166. 'Esame microscopico delle acque potabili', in Alessandri, P. E. & L. *Maggi: Acque potabili considerate come bevanda dell'uomo e dei bruti*. Milan: Dumolard, pp. 255-366.

167. 'Intorno all'importanza dell'esame bacteriologico qualitativo delle acque potabili'. *Rend*^{2} 20:463-469.

168. 'Intorno all'esame microscopico delle acque potabili'. *Boll. sc.* 9:52-55.

169. 'Sulla presenza di bacteri nella grandine'. *Boll. sc.* 9:57-58.

170. 'Esame microscopico dell'acqua piovana'. *Boll. sc.* 9:84-86.

171. 'Alcune notizie per la protistologia medica'. *Gazzetta medica italiana. Lombardia* 47 (8th ser. 7):485-487, 495-498.

172. 'Intorno alla determinazione delle specie bacteriche secondo Pflügge, ossia mediante i caratteri desunti dalle loro colture'. *Boll. sc.* 9:101-119.

173. 'Sulla proposta di laboratori di Zoologia lacustre'. *Boll. sc.* 9:offprint.

174. Various short notes: Rivista: Di alcune soluzioni; Intorno ad alcuni metodi di cultura delle acque potabili (Sunto); congresso univ. e Istituti superiori in Milano; congresso Medico; concorsi universitari, corsi liberi ecc., rec. Alessandri e Maggi. *Boll. sc.* 9.

1888

175. 'Intorno ai protozoi viventi sui muschi delle piante'. *Rend*^{2} 21:300-311.

176. 'Sull'importanza dei fagociti nella morfologia dei metazoi'. *Rend*^{2} 21:357-364.

177. 'Intorno ai bacterj della grandine'. Bollettino della Società Medica di Pavia, only issue: 53-54 [not identified], also: *Boll. sc.* 10:7-10.

178. 'Di alcune condizioni patologiche negli organismi superiori, analoghe a condizioni fisiologiche negli organismi inferiori'. *Gazzetta medica italiana. Lombardia* 47: 175-176 (summary in *Rend*^{2} 21:412-413).

179. 'Sur les Protozoaires vivant sur les mousses des plantes'. *Archives italiennes de Biologie* 10:184-189.

180. 'Antichità delle sinostosi'. *Boll. sc.* 10:82-85.

181. 'La trasformazione sperimentale della specie microbica o la novità scientifica della Bacteriologia sperimentale'. *Rivista di filosofia scientifica* 2nd ser. 8:15-38.

181bis 'La novità scientifica della bacteriologia sperimentale'. *Gazzetta medica italiana. Lombardia* 51 (9th ser. 1):505-507, 2:3-5, 11-12.

182. 'Distinzione delle Vampirelle e loro posto tra gli esseri organizzati secondo Dangeard'. *Boll. sc.* 10 offprint.

183. Various short notes: Intorno ai protozoi viventi sui muschi delle piante; Sull'importanza dei fagociti; Di alcune condizioni patologiche negli organismi superiori (Sunto), Le Amebe nelle dejezioni dissenteriche [...] e nella variola vera; Nomine, Laboratorio di Anatomia e Fisiologia Comparate, Laboratorio di Protistologia Medica. *Boll. sc.* 10.

1889

184. 'Protisti nello stomaco del cane durante la digestione di speciali alimenti'. *Gazzetta medica italiana. Lombardia*, also in *Rend²* 22:372-383.

185. Various short notes: Sui nephromyces (A. Giard); Nomine; Epoca della pubertà di alcuni mammiferi; Durata della gestazione nei mammiferi; Durata dell'accrescimento di alcuni mammiferi dopo la loro nascita; Durata della vita di alcuni mammiferi; Longevità di alcuni mammiferi; Laboratori; Nuovi Professori di Zoologia e di Anatomia e Fisiologia comparate. *Boll. sc.* 11.

1890

186. 'Alcuni problemi di Protistologia medica. *Gazzetta medica italiana. Lombardia* 49: offprint.

187. 'Due fatti craniologici trovati in alcuni mammiferi'. *Boll. sc.* 11 97-103.

187.b 'Deux faits craniologiques trouvés chez quelques mammifères'. *Archives italiennes de biologie* 15:119-124 (translation of M187).

188. 'Malattie microbiche dell'uomo e degli animali domestici'. *Boll. sc.* 11:68-75.

189. 'Sulla derivazione specifica dei microbi patogeni'. *Boll. sc.* 1:1-7.

190. 'Fontanelle nello scheletro cefalico di alcuni mammiferi'. 1st note. *Rend²* 23:439-461, plates 5-6.

191. 'Fontanelle nello scheletro cefalico di alcuni mammiferi'. 2nd note. *Rend²* 23: 580-608, plates 7-11.

192. 'Intorno al canale cranio-faringeo in alcuni rosicanti'. *Rend²* 23:719-729.

193. 'Il terzo occhio dell'uomo'. *Rivista di filosofia scientifica* 2nd ser. 9:677-692.

194. 'Il canale cranio-faringeo negli antropoidi'. *Rend²* 24 (1891): 138-149, plate 1; also in *Archivio per l'antropologia e la etnologia* 21 (1891): 53-64, one plate.

195. Various short notes: Recensioni/sunto. *Boll. sc.* 12.

1891

196. 'Sopra una varietà morfologica delle ossa nasali e intermascellari nell'Orango'. *Rend*^{2} 24:401-415, plate 3.
197. 'Sopra una diminuzione numerica dei denti nell'Orango (Satyrus Orang)'. *Rend*^{2} 24:586-593, plate 4.
198. 'Intorno alla forma primitiva delle ossa nasali nell'Orango (Satyrus Orang)'. *Rend*^{2} 24:808-820, plate 16.
199. 'I mesognati asinchiti nei giovani antropoidi'. *Rend*^{2} 24:993-999.
200. Various short notes: Recensioni, studi fatti a Genova (Corrado Parona), laboratorio Plön (Otto Zacharias). *Boll. sc.* 13.

1892

201. 'La sutura endomesognatica alla superficie facciale degli intermascellari nel Semnopithecus entellus'. *Rend*^{2} 25:89-90.
202. 'Intorno al nuovo regolamento per le scuole Superiori di Magistero'. *Boll. sc.* 14:26-32.
203. 'Sulla chiusura delle suture craniali nei mammiferi'. *Rend*^{2} 25:467-490.
204. 'Fontanelle nello scheletro cefalico di alcuni mammiferi. 3rd note'. *Rend*^{2} 25:592-602.
205. Various short notes: Recensioni. *Boll. sc.* 14.

1893

206. *Protistologia*. 2nd expanded edition. Milan: Hoepli.
207. 'Alcuni nuovi protisti'. *Boll. sc.* 15:13-17.
208. 'Intorno al foro pituitario ectocranico dei mammiferi'. *Rend*^{2} 26:703-716.
209. 'Importanza generale della Protistologia'. *Gazzetta medica italiana. Lombardia* 52 (9th ser. 5):553-556.
210. 'Coloranti e Protisti'. *Boll. sc.* 15: 87-94, 124-127, 16:22-32, 55-61, 80-89.
211. Various short notes: Bibliografie: Remy Perrier, L. Guinard, Protistologia, A. Falsan, H. Coupin, E. Kramer, F. Priem, Le Blanc, G. B. Bailliere, F. Mohrhoff, A. Lamari, Coupin, Coop. *Boll. sc.* 16.

1894

212. 'Fra i ciuffi di muschi'. *Italia Giovane* 1, reprinted with modifications and dedicated to Ernst Haeckel in the sixtieth year of his life precious to science and to humanity. Pavia: Tipografia e Legatoria Cooperativa.
213. 'Preinterparietale e fontanella interparietale in un idrocefalo di Bos Taurus juv'. *Rend*^{2} 27:160-171, plate 1
214. 'Sull'interparietale del Leone'. *Rend*^{2} 27:234-243, plate 3

215. 'Alcune varietà morfologiche dei preinterparietali asinchiti'. *Rend*[2] 27:417-432, plate 5.

216. Various short notes: Rec. Pavesi, Bibliogr. Brehm, La Marca, Constantin, Gaubret, Bailliere, Haeckel, Coop, Constantin, "Salute pubblica". *Boll. sc.* 16.

1895

217. *Tecnica protistologica*. Manuali Hoepli 196-197. Milan: Hoepli.

218. 'Foro pituitario ectocranico e interparietale in un neonato di Pteropus medius'. *Rend*[2] 28:813-815.

219. *Sulla sottrazione di locali al nuovo Istituto di Anatomia e Fisiologia comparate della R. Università di Pavia nell'ex Palazzo Botta*. Pavia: Tipografia Cooperativa.

220. 'Ossa bregmatiche e parabregmatiche nei mammiferi'. *Boll. sc.* 17:65-76.

221. 'Intorno al canale cranio-faringeo nei felidi e jenidi'. *Boll. sc.* 17:93-98, 18:8-18.

222. Various short notes: Bibliogr. Berlese, Ficalbi, G. Cattaneo, Bailliere, Tecnica protistologica. *Boll. sc.* 17.

1896

223. 'Varietà morfologiche degli interparietali e preinterparietali nei feti, neonati, e giovani di cavallo'. *Rend*[2] 29:319-343, plate 1.

224. 'Centri di ossificazione e principali varietà morfologiche degli interparietali nell'uomo'. *Rend*[2] 29:634-657, 716-736.

225. 'Risultati di ricerche morfologiche intorno ad ossa e fontanelle nel cranio umano'. *Rend*[2] 29:896-903.

226. 'Necrologio (Dott. Raffaello Zoja)'. *Boll. sc.* 18:83-89.

227. 'Recensione sui centri di ossificazione e principali varietà morfologiche degli interparietali nell'uomo'. *Boll. sc.* 18:71-77.

228. 'Centre d'ossification et principales variétés morphologiques des interpariétaux chez l'homme'. *Archives italiennes de biologie* 26:301-307.

229. Various short notes: Rec. Janet, Berlese, Gay, De Giovanni, necrologio Raffaello e Alfonso Zoja. *Boll. sc.* 18.

1897

230. 'Le ossa bregmatiche nei fossili'. *Rend*[2] 30:230-252, plate 2.

231. 'Postfrontali nei mammiferi'. *Rend*[2] 30:538-562, 634-646, plate 3.

232. 'Postfrontali nei mammiferi e cintura ossea (Sunto con aggiunte)'. *Boll. sc.* 19:57-62, 83-87.

233. 'Résultats de recherches morphologiques sur des os et des fontanelles du crâne humain'. *Archives italiennes de biologie* 27:230-238.

234. 'Festa scientifica: 25° anniversario della fondazione della stazione Zoologica di Napoli'. *Boll. sc.* 19:64.
235. 'Altri risultati di ricerche morfologiche intorno ad ossa craniali, cranio facciali e fontanelle nell'uomo ed altri mammiferi'. *Rend*^{2} 30:1164-1178.
236. 'Intorno all'evoluzione dei postfrontali'. *Rend*^{2} 30:1007-1013.
237. 'Altri risultati di ricerche morfologiche intorno ad ossa craniali, cranio facciali e fontanelle dell'uomo ed altri animali'. *Boll. sc.* 19 87-96.
238. 'Les os bregmatiques chez les fossiles'. *Archives italiennes de biologie* 27:362-375.
239. 'A proposito delle ossa bregmatiche nei fossili'. *Rend*^{2} 30:1521-1524.
240. Various short notes: Rec. Haeckel, sunti, Necrologi Trinchese, Kleinenberg. *Boll. sc.* 19.

1898

241. 'Placche osteodermiche interparietali degli Stegocefali e rispondenti centri di ossificazione interparietali dell'uomo'. *Rend*^{2} 31:211-228, plate 1.
242. 'Postfrontaux chez les mammifères'. *Archives italiennes de biologie* 28:329-340.
243. 'Intorno alle ossa bregmatiche degli Ittiosauri'. *Boll. sc.* 20:6-8.
244. 'Omologie craniali fra Ittiosauri e feti dell'uomo e d'altri mammiferi'. *Rend*^{2} 31:631-641.
245. 'Il canale cranio-faringeo negli Ittiosauri omologo a quello dell'uomo e di altri mammiferi'. *Rend*^{2} 31:761-771.
246. 'Uno schiarimento a proposito delle ossa bregmatiche nei fossili'. *Boll. sc.* 19 offprint.
247. 'Le ossa sovraorbitali nei mammiferi'. *Rend*^{2} 31:1089-1099, plate 4.
248. 'Serie di ossicini mediani del tegmen cranii in alcuni cani (Canis) e loro omologhi ed omotopi in alcuni Storioni (Acipenser)'. *Rend*^{2} 31:1473-1492, plate 5.
249. 'Autres résultats de recherches morphologiques sur des os craniens et cranio-faciaux et sur des fontanelles de l'homme et d'autres mammifères'. *Archives italiennes de biologie* 28:161-171.
250. Various short notes: Recensioni, Bibliografia: Ficalbi. *Boll. sc.* 20.

1899

251. 'Ossicini suturo-fontanellari nel cranio dell'uomo fossile'. *Rend*^{2} 32:465-484.
252. 'Fontanella metopica e frontali medi quadruplici nei vertebrati superiori'. *Rend*^{2} 32:671-681, plate 1.
253. 'Ossicini bregmatici negli uccelli'. *Rend*^{2} 32:1098-1101

254. ‘Ossicini metopici negli uccelli e nei mammiferi’. *Boll. sc.* 21:65-72.

255. ‘Ossicini metopici negli uccelli e nei mammiferi’. *Rend*^{2} 32:1274-1291, plate 4.

256. ‘Ossicini fontanellari coronali e lambdoidei nel cranio dei mammiferi e dell’uomo’. *Boll. sc.* 21:97-103.

257. ‘Nuove fontanelle craniali’. *Rend*^{2} 32:1297-1303.

258. ‘Commemorazione del Prof. G. Zoja’. *Boll. sc.* 21 128-135.

259. ‘Necrologio del Prof. G. Zoja’. *Boll. sc.* 21 135-140.

260. ‘L’Istituto di Anatomia e Fisiologia comparate e di Protistologia della R. Università di Pavia’. *Boll. sc.* 21: 20-27, also in *Annuario della R. Università di Pavia (anno scolastico 1899-1900).* Pavia.

261. ‘Note craniologiche dal 1897 al 1899-900’. *Boll. sc.* 21:37-43, 72-74, 103-115 (ref. M220, M237.

261bis ‘Intorno al cranio umano di Castenedolo’. *Boll. sc.* 21:87-88.

262. Various short notes: Recensioni, Bibliografia: Emery, Haeckel (Welträthsel). *Boll. sc.* 21.

1900

263. ‘Ossicini fontanellari coronali e lambdoidei nel cranio di mammiferi e dell’uomo’. *Rend*^{2} 33:298-315, 321-331, plate 1.

264. ‘Ossicini craniali nel Vespertilio murinus Schreb. e nel Rhinolophus ferrum equinum Keys. u. Blas.’ *Rend*^{2} 33:918-919.

265. ‘Sullo sviluppo dell’os planum nell Stenops gracilis e wormiani orbitali’. *Rend*^{2} 33:688-694.

266. Sul significato morfologico degli ossicini petro-esoccipito-sovraoccipitali ed esoccipito-sovraoccipitali. Lecture given at the congress of the Unione zoologica italiana, summary in *Monitore Zoologico* 1900 Supplement: 14-16.

1901

267. ‘Nuovi ossicini craniali negli antropoidi e loro significato morfologico’. *Rend*^{2} 34:147-163, plate 1.

268. ‘Aggiunte ai nuovi ossicini craniali negli antropoidi’. *Rend*^{2} 34:471-475.

269. ‘Di un carattere osseo-facciale dei giovani Gorilla’. *Rend*^{2} 34:547-556.

270. ‘Semi-ossicini fontanellari coronali e lambdoidei ed andamento di suture nel cranio di mammiferi e dell’uomo’. *Rend*^{2} 34:1105-1117, 1 plate.

271. ‘A proposito della denominazione di “Isola Virginia” del lago di Varese’. *Rend*^{2} 34:1102-1104.

1902

272. *Elenco delle pubblicazioni del Prof. Leopoldo Maggi.* Pavia: Succ. Bizzoni.

273. 'Postfrontali e sovraorbitali negli animali e nell'uomo adulto'. *Rend*^{2} 35:534-541.

274. 'Intorno alla formazione del foro sovraorbitale'. *Rend*^{2} 35:706-714.

275. 'La tachigenesi e gli studi universitari'. *Rend*^{2} 35:823-834, summary in *La Provincia pavese* (newspaper) no. 134, Nov. 1902.

1903

276. 'Una visita agli antropoidi del museo civico di Genova'. *Rend*^{2} 36:210-215.

277. 'Intorno ai prefrontali negli ittiopsidi e sauropsidi'. *Rend*^{2} 36:903-918.

278. 'In morte di Carlo Gegenbaur'. *Rend*^{2} 36:1022-1024.

279. 'L'anatomia comparata secondo Vogt e Yung'. *Rend*^{2} 36:1123-1128.

1904

280. 'Suture ed ossa intraparietali nel cranio umano di bambino e di adulto'. *Rend*^{2} 37:419-430.

281. 'Novità craniali negli equidi'. *Rend*^{2} 37:792-801

282. 'Prefrontali nei mammiferi e l'uomo'. *Rend*^{2} 37:826-838.

282.b 'Gli occhi di alcuni muschi'. Varietas. *Casa e famiglia* 1:252-254.

1905

283. *Coordinare e comparare*. Pavia: Litografia Tachinardi e Ferrari.

Categories assigned by Maggi (in M272):

General Natural History: 78

Geology: 3, 5, 15, 16, 28, 37, 39, 43, 44, 79

General Morphology: 94, 91, 150, 151, 176, 84, 85, 51, 2, 132, 178, 180, 193, 119, 97, 116, 154.

Plasmogonia (Heterogeny): 6-11, 13, 14, 18-20, 26, 23, 25, 24, 27, 38, 50, 57, 66, 67, 74, 46, 12, 34

Protistology: 209, 109, 72, 68, 45, 52, 62, 63, 71, 88, 89, 70, 193, 104, 105, 58, 60, 69, 59, 76, 99, 100, 102, 111, 143, 146, 155, 61, 64, 101, 120, 175, 179, 212, 207, 170, 169, 177, 141, 106, 110, 122, 124, 112, 113, 129, 133, 134, 135, 142, 152, 165, 166, 90, 98, 162, 158, 159, 160, 139, 130, 131, 123, 127, 145, 147, 148, 149, 153, 157, 161, 171, 181, 186, 188, 189, 172, 126, 184, 182, 121, 206

Protistotechnique: 136, 137, 163, 210, 217

Zoology, Comparative Anatomy and Physiology: 1, 4, 17, 30, 31, 47, 48, 54, 55, 75, 82, 83, 86, 93, 125, 173

Teratology: 114, 115, 92

Palaeoarcheology: 29, 32, 36, 40, 41, 42, 81

Palaeoantropology: 21, 22, 49, 77, 80, 261 bis

Cephalic Skeleton (Craniology (craniography, craniogeny) and facial Skeleton): 33, 35, 187, 190, 191, 204, 252, 257, 225, 233, 235, 237, 249, 203, 213, 215, 223, etc.

Bibliography

Archival sources:

Ernst-Haeckel-Haus, Jena: correspondence, manuscripts.
Zoologisches Institut der Friedrich-Schiller-Universität Jena: offprint collection.
Università degli studi di Pavia: University archive, archive of the Istituto di Anatomia e fisiologia comparate.[326]
Istituto Lombardo, Accademia di Scienze e Lettere (Milan): file Maggi.
Archivio comunale di Varese
Museo di Storia naturale (Milan)

Published works:[327]

Ackerknecht, Erwin H. (1957): *Rudolf Virchow*. Stuttgart: Enke.
— (1968): 'Mediziner und Zellenlehre'. *Gesnerus* 25: 188-194.
Agrifoglio, Lino (1954): *Igienisti italiani degli ultimi cento anni*. Milan: Hoepli (*Studi di Storia della Medicina* XI).
Altmann, Richard (1890): *Die Elementarorganismen und ihre Beziehungen zu den Zellen*. Leipzig: Veit.
— (^{2}1894): *Die Elementarorganismen und ihre Beziehungen zu den Zellen*. Leipzig: Veit [1890], reprint 2007 Saarbrücken: VDM-Verlag.
Altner, Günter (1966): *Charles Darwin und Ernst Haeckel*. Zürich: EVZ.
Amrein, Martin & Kärin Nickelsen (2008): 'The Gentleman and the Rogue: The Collaboration Between Charles Darwin and Carl Vogt'. *Journal of the History of Biology* 41: 237-266. Published online: 11 October 2007. DOI: 10.1007/s10739-007-9144-6

326 References to Maggi's published works are given in the format "**M000**", the number referring to the entry in his own printed bibliography of 1901, updated in his handwriting, copy in the library of the *Istituto di Anatomia e fisiologia comparate*, University of Pavia; reproduced with additions and corrections at the end of this bibliography.
327 Recently, the availability of digital reproductions of out-of-copyright texts has grown enormously. In cases where I have consulted authentic facsimile versions, this fact has not been noted in the bibliography. Sites used predominantly include gallica.bnf.fr, www.archive.org, edocs.ub.uni-frankfurt.de, www.biolib.de, and books.google.com. All web links, if not stated otherwise, have been confirmed in July 2008.

Andres, A[ngelo] (1901): *La lotta per l'esistenza sostenuta dall'uomo contro gli animali*. Parma: Maldi.
Anon. (1904): 'The Freethought Congress at Rome'. *The Monist* 14 (5): 777-779.
Anon. (1905): 'Leopoldo Maggi'. *Bullettino di paletnologia italiana* 31: 83.
Anon. (1937): 'Ludwig Stieda (1837-1918)'. *Nature* 140: 840.
Anon. (1940): 'Leopoldo Maggi (1840-1906) [sic!]'. *Nature* 145, May 11, p. 736.
Anon. (1997): 'Pfahlbaumuseen/Pfahlbausammlungen', in: Schlichtherle (ed.): *Pfahlbauten*, p. 121.
Appel, Toby A. (1987): *The Cuvier-Geoffroy Debate. French biology in the decades before Darwin*. Oxford: OUP.
Appert, Nicolas (1810): *L'Art de conserver les substances animales et végétales*. Paris: Patris.
Armocida, Giuseppe (2007): 'Luigi Calori nella storia della medicina', in Ruggeri (ed.): *Luigi Calori*, pp. 21-31.
—, Serena Contini & Ezio Vaccari (eds., 2002): *Leopoldo Maggi (1840-1905): un naturalista eclettico nella Lombardia di secondo Ottocento*: atti del convegno Cuveglio, 23 novembre 2002. Valcuvia: Comunità montana della Valcuvia, 2002. (*Terra e gente*, vol. 10, special issue).
Artigas, Mariano, Thomas F. Glick & Rafael A. Martínez (2006): *Negotiating Darwin. The Vatican Confronts Evolution 1877-1902*. Baltimore: Johns Hopkins UP.
Artini, Ettore (1907): 'Commemorazione di Leopoldo Maggi, letta nella solenne adunanza del 10 gennajo 1907'. *Rendiconti. R. Istituto Lombardo di Scienze, Lettere e Arti*, ser. 2, 40: 88-97.
Aspes, Alessandra (1997): 'Die Pfahlbauten in Norditalien', in: Schlichtherle (ed.): *Pfahlbauten*, pp. 56-62.
— (ed. 1983): *Palafitte: Mito e realtà*. Verona: Museo civico di storia naturale/ Varese: Musei civici.
Associazione internazionale del libero pensiero (n.d.): *Congresso internazionale di Roma, XX-XXIII Settembre MCMIV*. Milan: Comitato Centrale dell'Associazione Italiana [consulted copy in British Library, call nr. 4016 d 45, of this hard-to-find document].
Audouin, Jean Victor et al. (1822-1831): *Dictionnaire classique d'histoire naturelle*. Paris: Rey & Gravier, 17 vols.
— et al. (1831-1841): *Dizionario classico di storia naturale*. Venice: Tasso, 16 vols.
Babini, Valeria P. & Raffaella Simili (eds., 2007): *More Than Pupils. Italian Women in Science at the Turn of the 20th Century*. Florence: Olschki.
— (2007a): 'In the Name of Father. Gina and Cesare Lombroso', in eadem & Raffaella Simili (eds.): *More Than Pupils*, pp. 75-105.
Baima Bollone, Pierluigi (1992): *Cesare Lombroso, ovvero Il principio dell'irresponsabilità*. Turin: SEI.
Baker, John R. (1948-1955): 'The Cell-theory: a Restatement, History, and Critique'. *Quarterly Journal of Microscopical Science* 89 (1) (1948): 103-125, 90

(1) (1949): 87-108, (3): 331; 93 (1952); 94 (4) (1953): 407-440; 96 (4) (1955): 449-481
Baldi, Alberto (1988a): Antropologia italiana della seconda metà dell'Ottocento: dagli interessi per la cultura delle popolazioni „altre" alle ricerche in ambito folklorico. In Fedele & Baldi (eds.): *Alle origini*, pp. 117-177.
Balsamo Crivelli, Gius[eppe] & Leopoldo Maggi (1867): Sulla produzione di alcuni organismi inferiori. Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali 4: 171-174.
Balsamo Crivelli, Giuseppe & Leopoldo Maggi (1867): 'Sulla produzione di alcuni organismi inferiori'. *Memorie del R. Istituto Lombardo di Scienze, Lettere e Arti* 10 (=ser. 3, 1), no. 16/2.
Balsamo Crivelli, Giuseppe & Leopoldo Maggi (1867): Sulla produzione di alcuni organismi inferiori in presenza dell'acido fenico. Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali 4: 354-368.
Balsamo Crivelli, Giuseppe & Leopoldo Maggi (1868): 'Intorno alla produzione del Leptothrix', *Rendiconti. R. Istituto Lombardo di Scienze, Lettere e Arti*, serie 2, 1: 51-56.
Balsamo Crivelli, Giuseppe (1874): 'Sulla storia naturale degli esseri inferiori del professore Leopoldo Maggi'. *Rendiconti. R. Istituto Lombardo di Scienze, Lettere e Arti*, serie 2, 7 fasc. 15-16 (4pp.).
Banchieri, Daria Giuseppina (1992): *Archeologia. I cocci e gli ori dei nostri predecessori*. Varese: Lativa.
Barbagli, Fausto & Clementina Rovati (2002): 'Lo sviluppo dei Musei di Storia naturale a Pavia sotto la direzione di Leopoldo Maggi', in Armocida et al. (eds.): *Leopoldo Maggi*, pp. 67-74.
— (2005): 'Il pensiero di Ernst Haeckel nell'opera di Leopoldo Maggi', in Rovati & Violani (eds.): *Leopoldo Maggi*, pp. 14-16.
— (2006): 'Maggi, Leopoldo', in *Dizionario Biografico degli Italiani*. Rome: Istituto della Enciclopedia Italiana, vol. 67, pp. 351-352.
Barbano, Filippo (1989): L'età (1850-1910) e la cultura del positivismo rivisitate. Una bibliografia (1960-1980). In: Ancaran, Vittorio (ed.): *La scienza accademica nell'Italia post-Unitaria*. Milan: Angeli, pp. 257-272.
Barone, F[rancesco]. (1951): entry 'Haeckel', in *Enciclopedia Italiana*. Rome: Treccani, vol. 18, pp. 434-435.
Barrett, Paul, et al. (eds., 1987): *Charles Darwin's Notebooks, 1836-1844*. Ithaca: Cornell University Press.
Barthes, Roland (1967): 'The Death of the Author'. *Aspen* 5-6: item 3.1.
Bartoccini, Fiorella, & Silvana Verdini (1952): *Sui Congressi degli Scienziati*. Roma: Ateneo.
Basso, Laura (1990): *Dal Museo Patrio ai Musei Civici 1871-1965*. Varese: Centro litografico comunale.

Bastian, H[enry] Charlton (1871): *The Modes of Origin of Lowest Organisms*. London: MacMillan.
— (1872): *The Beginnings of Life*. 2 vols. London: MacMillan.
Battimelli, Giovanni (2000): 'I luoghi e le forme della comunicazione scientifica', in: Casella, Antonio, & al (eds.): *Una difficile modernità. Tradizioni di ricerca e comunità scientifiche in Italia 1890-1940*. Pavia: La Goliardica, pp. 1-17.
Bazzi, Franco & R. Manara (1980): *Il concetto e la pratica della batterioterapia: Contestazione di una priorità*. Genova: Istituto di igiene dell'Università di Genova (*Quaderno* 1).
Belgiojoso, Carlo (1868): 'La tutela dei monumenti patrj'. *Rendiconti del R. Istituto Lombardo di scienze e lettere, 2nd series* 1: 94-105, 138-150.
Belloni, Luigi (1972): 'L'anemia del Gottardo'. *Gesnerus* 29: 33-44.
Belloni, Luigi (1973): Haeckel als Schüler und Assistent von Virchow. *Physis* 15: 5-39.
Belloni, Luigi (1978): 'Contributi della Università di Pavia (Grassi-Golgi-Negri) alla diagnosi microscopica dell'anchilostomiasi della malaria e della rabbia'. *Memorie Istituto Lombardo, Classe di Scienze matematiche e naturali* 27 (2): 29-48.
Belloni, Luigi (1980): 'Franz Boll, scopritore della porpora retinica. Sue lettere a Emil Du Bois-Reymond, Camillo Golgi e Ernst Haeckel'. *Memorie. Istituto Lombardo di Scienze e Lettere. Classe di Scienze matematiche e naturali* 27 (6): 315-437.
Benassi Graffi, Elsa (1957): 'Fabio Frassetto'. *Annuario dell'Università di Bologna per gli anni 1952-54*: 154-156.
Benasso, Giambattista: "Materiali per una storia dell'evoluzionismo italiano", in: *Atti della Accademia Roveretana degli Agiati*, serie VI, vol. XIV-XV (1976), f. B, pp. 5-105; vol. XVI-XVII (1978), f. B: 73-152; vol. XX (1981), f. B, pp. 93-168.
Benini, Aroldo (1980): *Mario Cermenati e il suo tempo*. Lecco: Banca popolare.
Benson, Keith R. (1988): 'Review Paper: The Naples Stazione Zoologica and its Impact on the Emergence of American Marine Biology'. *J. Hist. Biol.* 21 (2): 331-341.
Berg, Alexander & Hugo Freund (eds. 1964-1966): *Geschichte der Mikroskopie*. 3 vols. Frankfurt: Umschau.
Bernabò Brea, Maria (1997): 'Die Terramaren in der Poebene', in: Schlichtherle (ed.): *Pfahlbauten*, pp. 63-70.
Bernardini, Gene (1977): 'The Origins and Development of Racial Antisemitism in Fascist Italy'. *Journal of Modern History* 49 (3): 431-453.
Bianconi, Giovanni Giuseppe (1864): *La teoria dell'Uomo-scimmia esaminata sotto il rapporto della organizzazione*. Bologna: Gamberini e Parmeggiani.
Bianconi, J. Joseph [i.e., Giovanni Giuseppe] (1874): *La théorie darwinienne et la création dite indépendante. Lettre à M. Darwin*. Bologne: Zanichelli.
Binet, Alfred (1890): 'The Immortality of Infusoria'. *The Monist* 1 (1): 21-37.

Blankenhorn, A. & J. Moritz (1875): *Die Wurzellaus des Weinstockes, Phylloxera vastatrix*. Heidelberg: Winter (offprint from *Annalen der Oenologie* 5).
Bödeker, Hans Erich (ed., 2003): *Biographie schreiben*. Göttingen, Wallstein Verlag, 2003 (*Göttinger Gespräche zur Geschichtswissenschaft* 18).
Bonardi, Edoardo (1904): *Le ostilità dei conservatori contro la scienza*. Milan: Critica sociale.
— (1910): *L'origine e la posizione dell'uomo nella natura*. Milan: Università popolare.
— (1913): 'Intorno ad alcuni punti del pensiero e dell'opera scientifica di Leopoldo Maggi di fronte all'attuale momento scientifico'. *Rendiconti. Reale Istituto Lombardo di Scienze e Lettere* ser. 2 vol. 46: 591-600.
Borrelli, Antonio (1990-91): 'Paolo Panceri nella Napoli del secondo Ottocento'. *Fridericiana* 2: 93-113.
Bory de Saint-Vincent (1825): 'Histoire naturelle', in Audouin et al.: *Dictionnaire classique*, vol. 8: 244-252.
— (1828): 'Psychodiaire', in Audouin et al.: *Dictionnaire classique*, vol. 14:329-335.
Bowler, Peter J. (1983): *The Eclipse of Darwinism*. Baltimore: Johns Hopkins University Press.
Bowler, Peter J. (2007): 'Julian Huxley: Religion without Revelation', in Rupke (ed.): *Eminent Lives…*, pp. 139-156.
Braga, Giovanni (1995): 'Le Scienze della Terra a Pavia tra Otto e Novecento: la figura di Torquato Taramelli'. *Annali di Storia Pavese* 22-23:405-411.
Brambilla, Luigi (1874): *Varese e suo circondario*. Varese: Ubicini, 2 vols.
Breidbach, Olaf (1997): 'Entphysiologisierte Morphologie: Vergleichende Entwicklungsbiologie in Nachfolge Haeckels'. *Theory in Biosciences* 116: 328-348.
— (2001): 'Der Gegenpapst. Über Ernst Haeckels Welt- und Naturanschauung', in Röder & Ulbrich (eds.): *Welträtsel und Lebenswunder*, pp. 19-35.
— (2005): 'Monismo, positivismo e "ideologia tedesca"', in: Frigo, Gian Franco & Olaf Breidbach (eds.): *Scienza e filosofia nel positivismo italiano e tedesco*. Padua: Poligrafo, pp. 13-30.
Brömer, Rainer (1993): 'Ernst Haeckel und die Italiener. Zeugnisse aus dem Briefnachlaß', in Centro Internazionale di Storia dello Spazio e del Tempo (CISST)(ed.): *Haeckel e l'Italia*, pp. 79-102.
— (1994) 'Evolution und Verbrechen', in: Baumunk, Bodo M. & Jürgen Rieß (eds.): *Darwin und Darwinismus*. Berlin: Akademie-Verlag, pp.128-133.
— (2000): '"Monismus" bei Ernst Haeckel: Skizze einer historischen Einordnung', in: Zigman, Peter (ed.): *Einblicke in eine sterbende Ära: Das Ende des Mythos der Guten Alten Zeiten*. Bratislava: Comenius University (=*Philosophica* 32), pp. 45-74.

— (2006) 'Leopoldo Maggi (1840-1905) – Personal life in the Italian Risorgimento' in Zigman, Peter (ed.) *Die biographische Spur in der Kultur- und Wissenschaftsgeschichte*. Jena: Garamond, pp. 161-180.
— (2009): 'Darwinism in the Kingdoms of Italy and Nature', in: Engels, Eve-Marie & Thomas F. Glick (eds.): *Darwin in Europe*, vol. 2, pp. 375-385. London: Continuum.
Brooke, John H. (ed., 1991): *Science and Religion*. Cambridge: Cambridge University Press.
— (2006) 'Overtaking Nature? The Changing Scope of Organic Chemistry in the Nineteenth Century', in Bensaude-Vincent, Bernadette & William R. Newman (eds., 2007): *The Artificial and the Natural. An Evolving Polarity*. Cambridge MA: MIT Press, pp. 275-292.
Browne, Janet (1995): 'E le mogli?', in La Vergata (ed.): *Le biografie scientifiche. Intersezioni* 15: 165-169.
Brunelli, Gustavo [1900]: 'Darwin, e innanzi a Darwin', in: Darwin, Charles R.: *Sulla origine delle specie*. Trad. di G. Canestrini, Vol. I, pp. 9-26. Milano: Ist. Editoriale Italiano
Brunelli, Gustavo [1900b]: 'Dopo Darwin'. In: Darwin, Charles R.: *Sulla origine delle specie*. Trad. di G. Canestrini, Vol. II, pp. 281-333. Milano: Ist. Editoriale Italiano
Brunner, C[arl] *fils* (1852): 'Aperçu géologique des environs du Lac de Lugano'. *Neue Denkschriften der allgemeinen schweizerischen Gesellschaft für die gesammten Naturwissenschaften* 12, 18 pp.
Bucchi, Massimiano (1997): The Public Science of Louis Pasteur: The Experiment of Anthrax Vaccine in the Popular Press of the Time. *Hist. Phil. Life Sci.* 19: 181-209.
Büchner, [Ludwig] Louis (1869): *Conférences sur la théorie darwinienne*. Leipzig: Thomas/Paris: Reinwald, trad. Auguste Jacquot. Preface, sommaire, avant-propos du traducteur.
Büchner, Ludwig (1855): *Kraft und Stoff*. Frankfurt am Main: Meidinger.
Burkhardt, Frederick (1985-): *The Correspondence of Charles Darwin*. Cambridge: Cambridge University Press.
Bütschli, Otto (1880): *Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs* 1.I. Leipzig/Heidelberg: Winter.
Calori, Luigi (1867): 'Intorno alle suture soprannumerarie del cranio umano e su quelle specialmente delle ossa parietali'. *Memorie dell'Accademia delle scienze dell'istituto di Bologna*, ser. 2., v. 6, 327-343, 1 plate.
Calvi, Felice (1884): *Famiglie notabili milanesi*, vol. 3. Milan: Vallardi.
Camerano, Lorenzo (1880): *Dell'indole odierna degli studi zoologici*. Turin: Loescher.
— (1892): *Anatomia comparata*. Milan: Vallardi.
— (1910): 'Franco Andrea Bonelli ed i suoi concetti evoluzionistici (1812-1830)'. *Memorie R. Acc. Sci. Torino*, ser. 2 60: 409-467.

— (1912): 'Gli studi zoologici in Italia nel primo cinquantennio di vita nazionale'. *Atti Società italiana per il progresso delle scienze, 5a riunione 1911*, offprint.

Canestrini, Giovanni (1866): *L'antichità dell'uomo*. Modena: Vincenzi.

— (1866a) *L'origine dell'Uomo*. Milan: Brigola.

— (1867): 'Caratteri anomali e rudimentali in ordine all'origine dell'uomo'. *Annuario della Società dei Naturalisti di Modena* 2: 81-99.

— (1867b): 'Intorno alla teoria della trasformazione delle specie ed all'origine dell'uomo'. *Annuario Filosofico del Libero Pensiero* (for the year 1867). Milano: Gareffi.

— (1867a): Cenni critici intorno alla teoria del Kölliker sull'origine delle specie. In: Annuario della Società dei naturalisti in Modena 2, Sdr. 11 pp.

— (1869): 'La zoologia odierna'. *Gazzetta Medica Italiana - Provincie Venete* 12 (49), 20pp

— (1869-1871): *Compendio di zoologia ed anatomia comparata*. 3 vols. Milan: Brigola.

— ([2]1870): *Origine dell'uomo*. Milano: Brigola.

— (1877) *La teoria dell'evoluzione esposta ne' suoi fondamenti*. Turin: UTET.

— (1881): 'Intorno alla ereditarietà dei caratteri individuali'. *RdFS* 1, offprint.

— (1881/2): 'L'indirizzo della biologia odierna'. *RdFS*. 1 (3), offprint.

— (1882): *Commemorazione di Carlo Darwin*. Padova: Prosperini.

— (1882a): L'indirizzo della biologia odierna. In: Riv Fil. Sci. 1 (3), offprint.

— (1882b): *L'indirizzo della odierna biologia*. Padova: Brandi.

— (1882c): Carlo Darwin e la biologia. In: Riv Fil. Sci. 2 (3), 23 pp.39 pp.

— (1887): *La teoria di Darwin criticamente esposta*. Milan: Dumolard, pp. vii-xi, 348-397

— (1892): 'La teoria dell'evoluzione ed i batteridi'. *Bollettino della Società Veneto-Trentina di Scienze Naturali* 5 (2), offprint.

— (1894) *Per l'evoluzione*. Turin: UTET.

— (1897): *La evoluzione della teoria della discendenza*. Padova: Randi.

Canguilhem, Georges (1989): *Études d'histoire et de philosophie des sciences*. 5th expanded ed. Paris: Vrin, 226-262.

Cantoni [, Giovanni] (1865): 'Sperienze sulla eterogenesi'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali* 2: 309-311.

— (1867): Ancora su la produzione degli infusorj in liquidi bolliti. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali* 4: 275-291.

— (1867a): Altre sperienze su la produzione delgi infusorj. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali* 4: 321-328.

— (1868): 'Su alcune condizioni fisiche dell'affinità, e sul moto browniano'. *Rendiconti del R. Istituto Lombardo di scienze e lettere, 2nd series* 1: 56-67.

— & E[usebio] Oehl (1866): Ricerche sullo sviluppo degli infusorj considerato in se stesso e in relazione colla sua genesi. *Annali universali di medicina* 196 (=4th ser. vol. 60): 332-411. Scanned at http://emeroteca.braidense.it.
—, with [Eusebio] Oehl (1866a): 'Esperienze sulla produzione dei vibrioni in liquidi bolliti'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali* 3: 243-259.
Capanna, Ernesto (1995): 'L'Unione zoologica italiana e la zoologia pavese: La storia di due ragazzi di campagna', in Fasola, Mauro (ed.): *Zoologia - Sviluppi a Pavia nel XX secolo*. Bologna: Cisalpino, pp. 15-20.
Cappelletti, Gino (1972): *Circolo filologico milanese. I suoi cento anni, 1872-1972*. Varese: La Tecnografica.
Cappieri, Mario (1955): 'Italy: An Anthropological Review for 1952-1954'. *Yearbook of Anthropology* 1955: 481-500.
Casadei, Francesco (1994): 'Italian Universities after National Unification'. *CIS-Newsletter* June 1994.
Casellato, Sandra (1982): 'Il darwinismo a Padova: Giovanni Canestrini'. *Atti Accad. Agiati* 231-232, ser. VI, vol 21-22. f. B, pp. 51-68.
Cash, James & George Herbert Wailes (1919): *British Freshwater Rhizopoda and Heliozoa*. London: Ray Society, vol. 4: *Supplement to the Rhizopoda and Bibliography*.
Cassedy, James H. (1976): 'The microscope in American medical science 1840-1860'. *ISIS* 67: 76-97.
[Cattaneo, Carlo] (1860) 'On the origin etc. *Sulla origine delle specie con mezzi di scelta naturale, ossia la Conservazione delle razze favorite nella lotta per vivere*, di Carlo Darwin. Londra 1859'. *Il Politecnico* 9: 110-112. Milano: Agnelli [republished in Cattaneo, Carlo (1964) *Scritti politici*. Ed. Mario Boneschi, Florence: Le Monnier, pp. 229-230].
Cattaneo, Giacomo (1878): 'Sulla produzione plasmogonica del Leptothrix e del Leptomitus'. *Rend. Ist. Lomb.* 2 11 (3).
— (1878a): 'Intorno all'ontogenesi dell'*arcella vulgaris* Ehr'. *Atti Soc. It. sc. nat.* 21 (reprint).
— (1878b): 'Sulla produzione plasmogonica del Leptothrix e del Leptomitus'. *Rend. Ist. Lomb.* ser. 2 vol. 11 (3) (offprint).
— (1879): 'Le individualità animali'. *Atti della Società Italiana di scienze naturali* 22, (reprint).
— (1879a): 'Intorno ai Rizopodi'. Boll. Sci. 1
— (1879b): 'L'evoluzione degli organismi'. *Boll. Sci.* 1
— (1879c): Sul significato morfologico delle parti esteriori del metovo. *Boll. Sci.* 1: 61-64.
— (1880): 'Darwinismo. Saggio sulla evoluzione degli organismi'.
— (1880a): 'L'unità morfologica e i suoi multipli'. *Boll. Sci.* 2
— (1882): 'Protisti del Lago di Como'. *Boll. Sc.* (4).
— (1882a): 'Sull'origine della metameria'. *Natura* (offprint).

— (1883): 'Fissazione, colorazione e conservazione degli infusori. Studi di tecnica protistologica'. *Boll. Sci.* (3+4)
— (1883a): 'Le forme fondamentali degli organismi'. *RdFS* 3 (1-3).
— (1884): 'La genesi della metameria. Risposta al prof. Carlo Emery'. *Giorn. Int. Sci. Med.* 6
— (1885): 'Idee di Giulio Cesare Vanini'. *RdFS* 4 (4)
— (1886) 'Giovanni Lamarck e Carlo Darwin'. *Rivista di filosofia scientifica* 5 (5), reprint, 36pp.
— (1886): 'L'origine dei sessi'. *RdFS* 5 (5).
— (1888): 'Sugli "Amebociti" dei Crostacei'. *Boll. Sci.* (1): 7-8 [vollst.??]
— (1888a): 'Sulla struttura e sui fenomeni biologici delle cellule ameboidi del sangue nel carcinus maenas'. *Atti Soc. It. di Sc. Nat.* 31: 231-266, Tav. 5.
— (1888): 'Su di un infusorio ciliato, parassito del sangue del carcinus maenas'. *Boll. Sci.* (1).
— (1890/1): 'Uno sguardo alla storia e alle condizioni presenti della Anatomia comparata'. *Rivista di Filosofia Scientifica* 11: 148-164.
— (1894): 'Linneo evoluzionista?' *Atti Soc. Lig. Sc. nat e geogr.* 5 (3)
— (1895): *Embriologia e morfologia generale*. Milan: Hoepli (=*Manuali Hoepli* 183).
— (1897): 'I fattori della evoluzione biologica'.
— (1899): 'L'Ortogenesi'. *Riv. Sc. Biol.* (1)
— (1900): 'I limiti della variabilità. (A proposito di un libro del prof. D. Rosa)'. *Riv. Sc. Biol.* 2 (1-2)
— (1901): 'I metodi somatometrici in Zoologia'. *Riv. Biologia Gen.* 3 (4-5).
— (1905): 'Leopoldo Maggi'. *Monitore zoologico italiano* 16: 78-81.
Cavalleri, G. M. (1865): 'Di alcuni esperimenti intorno alla questione della generazione spontanea degli infusorj'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali* 2: 331-348.
Cavalli Sforza, Luigi Luca & Francesco (1993): *Chi siamo. La storia della diversità umana*. Milan: Mondadori.
Cavani, Cristina (1992): *Evoluzionismo e fede in Antonio Fogazzaro*. PhD thesis, Bologna.
Cazzaniga, Antonio (1951): *La grande crisi della medicina italiana nel primo ottocento*. Milan: Hoepli.
Cermenati, Mario (1910): 'Nel cinquantenario dell'"Origine delle specie". I primi darwinisti italiani'. *Nuova Antologia di lettere, scienze ed arti* ser. 5 vol. 145 (16.2.1910): 601-632.
Certes, Adolphe-Adrien (1883): *Analyse micrographique des eaux*. Paris: Tignol.
Chadwick, Owen (1990): *The Secularization of the European Mind in the 19th Century*. Cambridge: CUP Canto [1975]
Charpentier, Jean de (1841): *Essai sur les glaciers et sur le terrain erratique du Bassin du Rhône*. Lausanne: Ducloux.
Cherlonneix, Laurent (2007): 'Recherches sur l'auto-initiation de la Mort cellulaire à la fin du XIXe siècle'. *Gesnerus* 64: 193-218.

Chiarelli, Brunetto & Giuseppe D'Amore (1997): 'Giuffrida-Ruggeri, Vincenzo', in Spencer, Frank (ed.): *History of physical anthropology: An Encyclopedia*. New York: Garland, vol. 1:440f.
— (2003): *Dalla natura alla cultura. Principi di antropologia biologica e culturale*, vol. 1. Padua: Piccin.
Churchill, Frederick B. (1989): 'The Guts of the Matter. Infusoria from Ehrenberg to Bütschli: 1838-1876'. *Journal of the History of Biology* 22:189-213.
— (2007): 'Living with the Biogenetic Law: A Reappraisal', in Laubichler, Manfred D. & Jane Maienschein (eds.): From Embryology to Evo-Devo: A History of Developmental Evolution. Cambridge MA: MIT Press, pp. 37-81.
Ciampi, Gabriella & Claudio Santangeli (eds., 1994): *Il Consiglio superiore della pubblica istruzione 1847-1928*. Rome: Ministero per i Beni Culturali e Ambientali (=*Pubblicazioni degli Archivi di Stato. Fonti* 18).
Cimino, Guido & C. Maccagni (1994): *La storia della medicina e della scienza tra archivio e laboratorio. Saggi in memoria di Luigi Belloni*. Florence: Olschki.
Cimutta, Jost (1962): 'Über Ernst Haeckels naturwissenschaftlichen Materialismus und seine Annahme der Allbeseeltheit des Universums'. *Wissenschaftliche Zeitschrift der FSU Jena* 11 (Gesellschafts- und sprachwiss. Reihe, issue 1): 17-28.
Cipollini, Maria Rita (1984): 'Il Fondo Grassi presso l'Istituto di Anatomia Comparata dell'Università di Roma'. *Rivista di storia della scienza* 1: 115-126.
CISST (ed. 1993): *Haeckel e l'Italia. La vita come scienza e come storia*. Brugine (PD): Centro Internazionale di storia dello spazio e del tempo.
Clark, Linda L[oeb] (1984): *Social Darwinism in France*. Alabama: UAlPr.
Clark, William (2006): *Academic Charisma and the Origin of the Research University*. Chicago/London: University of Chicago Press.
Clayton, Philip (ed., 2006): *The Oxford Handbook of Religion and Science*. Oxford: Oxford University Press.
Coccia, Paolo (2003): *Un secolo di evoluzionismo in Italia: Bibliografia 1859-1959. Con l'elenco completo delle opere di Charles Darwin pubblicate in Italia*. Prato: Partner-Ship.
Codell Carter, K. (1988): 'The Koch-Pasteur Dispute on Establishing the Cause of Anthrax'. *Bull. Hist. Med.* 62: 42-57.
Cole, F[rancis] J[oseph] (1926): *The History of Protozoology. Two Lectures Delivered Before the University of London at King's College in May 1925*. London: University of London Press.
Coleman, William (1987): 'Koch's comma bacillus: the first year'. *BHM* 61: 315-342.
Collins, Harry M. (1992): *Changing Order. Replication and Induction in Scientific Practice*. Chicago: University of Chicago Press [1985].
Conry, Yvette (1974): *L'introduction du darwinisme en France au xixe siècle*. Paris: Vrin.

Continenza, Barbara (1989): 'Il dibattito sul darwinismo in Italia nell'Ottocento', in Maccagni, C., & P. Fregulia (eds.): *Storia sociale e culturale d'Italia*. Vol. V: *La cultura filosofica e scientifica*, t. II: *La storia delle scienze*. Busto Arsizio: Bramante, pp. 534-584.

Contini, Serena (2002): 'Profilo biografico di un valcuviano illustre e la sua opera scientifica nel territorio varesino', in Armocida e. al. (eds.): *Leopoldo Maggi*, pp. 19-33.

Cook, H[arry] C[harles] (1997): '[Origins of ...] Tinctorial methods in histology'. *Journal of Clinical Pathology* 50:716-720.

Copeland, Herbert Faulkner (1956): *The Classification of Lower Organisms*. Palo Alto: Pacific.

Corbellini, Gilberto (2000): 'I malariologi italiani: storia scientifica e istituzionale di una comunità conflittuale', in Casella, Antonio, & al (eds): *Una difficile modernità. Tradizioni di ricerca e comunità scientifiche in Italia 1890-1940*. Pavia: La Goliardica, pp. 299-327.

Corliss, John O. ([2]1979): *The Ciliated Protozoa. Characterization, Classification and Guide to the Literature*. Oxford: Pergamon. [1961]

— (1989): 'The Protozoon and the Cell: A Brief Twentieth-Century Overview'. *Journal of the History of Biology* 22:307-323.

— (1996): 'Christian Gottfried Ehrenberg (1795-1876): glimpses into the personal life of the most exemplary early protistologist', in Schlegel, Martin & Klaus Hausmann (eds.): *Ehrenberg-Festschrift*, pp. 31-46.

Correnti, Venerando, & G.F. De Stefano (1989): 'Forerunners of Biological Anthropology in Italy'. *International Association of Human Biologists. Occasional Papers* 2 (5).

— & G.F. De Stefano (1990): 'History of Biological Anthropology in Italy. Part 2: The Century after Unification (1871-1970)'. *International Association of Human Biologists. Occasional Papers* 2 (6).

— & G.F. De Stefano (1991): 'History of Biological Anthropology in Italy. Part 3: Universities and Scientific Societies'. *International Association of Human Biologists. Occasional Papers* 3 (2).

— (1987): 'La Società Romana di Antropologia e l'opera di Giuseppe Sergi per l'Antropologia Italiana', in Mucciarelli, Giuseppe (ed.): *Giuseppe Sergi nella storia della psicologia e dell'antropologia in Italia*. Bologna: Pitagora, pp. 93-103.

Corsi, Pietro (1983) '"Lamarckiens" et "Darwiniens" à Turin (1812-1894)', in Conry, Yvette (ed.) *De Darwin au darwinisme*. Paris: Vrin, pp. 49-67.

— & Paul J. Weindling (1985): 'Darwinism in Germany, France, and Italy', in: Kohn, David (ed): *The Darwinian Heritage*. Princeton NJ: Princeton University Press, pp. 683-729.

Cosmacini, Giorgio (1980): 'Problemi medico-biologici e concezione materialistica nella seconda metà dell'Ottocento. *Storia d'Italia. Annali* 3 (*Scienza e tecnica*). Turin: Einaudi, pp. 813-861.

— (1982): 'Medicina, ideologie, filosofie nel pensiero dei clinici tra Ottocento e Novecento', in: *Storia d'Italia. Annali* 4 (*Intellettuali e potere*). Turin: Einaudi, pp. 1159-1195.
— (1984): 'Scienza e ideologia nella medicina del Novecento', in: *Storia d'Italia. Annali* 7 (*Malattia e Medicina*). Turin: Einaudi, pp. 1221-1267.
— (1995): *Storia della medicina e della sanità in Italia*. Bari: Laterza [1987]
Costenaro, Mario (1972): 'La "Rivista di filosofia scientifica" e il positivismo italiano'. *Giornale critico della filosofia italiana* 51 (53): 92-117.
— (1975): 'Scienza, filosofia e metafisica nella "Rivista di filosofia scientifica"'. *Giornale critico della filosofia italiana* 54 (56): 263-301
Crellin, J.K. (1966): 'The problem of heat resistance of micro-organisms in the British spontaneous generation controversies of 1860-1880'. *Med. Hist.* 10: 50-59.
Cremer, Thomas (1985): *Von der Zellenlehre zur Chromosomentheorie. Naturwissenschaftliche Erkenntnis und Theoriewechsel in der frühen Zell- und Vererbungsforschung*. Berlin: Springer.
Daccò, Gian Luigi (ed., 1991): *Antonio Stoppani tra scienza e letteratura*. Lecco: Musei Civici.
Dall'Olio, G. & I. Piva (2003): '1849. La chimica del "paradosso diabetico"'. *Giornale italiano di diabetologia e metabolismo (GIDM)* 23:85-90. Last acc. online at http://www.gidm.it/pdf/2-2003/Dallolio.pdf, 2 May 2008.
Darwin, Charles (1875): *The Variation of Animals and Plants Under Domestication*. Second edition, revised. London: Murray, 2 vols. [1868]
Darwin, Francis (1887): *The Life and Letters of Charles Darwin*. 3 vols. London: Murray.
Daum, Andreas (1998): *Wissenschaftspopularisierung im 19. Jahrhundert. Bürgerliche Kultur, naturwissenschaftliche Bildung und die deutsche Öffentlichkeit*. München: Oldenbourg.
— (1998a): 'Naturwissenschaften und Öffentlichkeit in der deutschen Gesellschaft'. *Historische Zeitschrift* 267: 57-90.
De Felice, Renzo (1993): *Storia degli ebrei italiani sotto il fascismo*. Turin: Einaudi [1961].
— (1995): *Mussolini il rivoluzionario*. Turin: Einaudi [1965].
— (1861): 'La fisiologia ed il professore Moleschott'. *Rivista italiana di scienze, lettere ed arti* 57 (27.11.1861): 933-935.
De Giovanni, Achille (1869): 'Sopra il fermento morbifero'. *Rendiconti del R. Istituto Lombardo* ser 2, 2: 345-349.
de Kruif, Paul (1996): *Microbe Hunters*. Introduction by F. Gonzalez-Crussi. San Diego, New York, London: Harcourt Brace [1926].
Delage, Yves (1903): *L'hérédité et les grands problèmes de la biologie générale*. 2nd ed. Paris: Reinwald.
De Liguori, Girolamo (1988): *Materialismo inquieto. Vicende dello scientismo in Italia nell'età del positivismo 1868-1911*. Roma/Bari: Laterza.

De Marinis, Raffaele (1983): 'Storia della scoperta delle palafitte varesine', in Aspes (ed.): *Palafitte*, pp. 71-83.

De Sarlo, F. (1888): 'La filosofia, la scienza e il darwinismo'. *Rivista di filosofia scientifica* 2nd ser. 8: 39-47.

Debré, Patrice (1994): *Louis Pasteur*. Paris: Flammarion.

Delzell, Charles F. (ed., 1970): *Mediterranean Fascism 1919-1945*. NY: Walker.

Desmond, Adrian (1994-97): *Huxley*, vol. 1: *The Devil's Disciple*, vol. 2: *Evolution's High Priest*. London: Joseph.

de Vries, Hugo (1889): *Intracelluläre Pangenesis*. Jena: Fischer.

Di Bartolo, Maurizio (2005): 'Il monismo psicologico italiano', in Frigo, Gian Franco & Olaf Breidbach (eds.): *Scienza e filosofia nel positivismo italiano e tedesco*. Padua: Poligrafo, pp. 47-87.

— (2005a): 'Le lettere di Enrico Morselli a Ernst Haeckel: Per un'introduzione', in Frigo, Gian Franco & Olaf Breidbach (eds.): *Scienza e filosofia nel positivismo italiano e tedesco*. Padua: Poligrafo, pp. 265-277.

Di Gregorio, Mario A. (1987): 'Panizza, Bartolomeo', in Porter, Roy (ed.): *Dizionario Biografico della Storia della Medicina e delle Scienze Naturali*. Milan: Ricci, vol. 2:198.

— (1990): *Charles Darwin's Marginalia*. Vol. I. New York & London: Garland.

— (1992): 'Entre Méphistophélès et Luther: Ernst Haeckel et la réforme de l'univers', in Patrick Tort (ed.): Darwinisme et société. Paris: Presses univ. de France, pp. 237-283.

— (1995): 'A Wolf in Sheep's Clothing: Carl Gegenbaur, Ernst Haeckel, the Vertebral Theory of the Skull, and the Survival of Richard Owen'. *J. Hist. Biol.* 28:247-280.

— (2005): *From Here to Eternity. Ernst Haeckel and Scientific Faith*. Göttingen: Vandenhoeck & Ruprecht.

Dini, Alessandro (1996): 'De Giovanni Achille (1838-1916)', in Tort (ed.): *Dictionnaire*, pp. 1139-1140.

Donné, Al[fred] (1863): 'Expériences sur l'altération spontanée des œufs' (presented by Louis Pasteur). *Comptes rendus hebdomadaires des séances de l'Académie des sciences* 57: 448-308.

— (1866): 'De la génération spontanée des moisissures végétales et des animalcules infusoires' (presented by Ch. Robin, with response by Louis Pasteur). *Comptes rendus hebdomadaires des séances de l'Académie des sciences* 63: 301-308.

— (1867): 'Expérience relative aux générations spontanées des animalcules infusoires'. *Comptes rendus hebdomadaires des séances de l'Académie des sciences* 64: 47.

Dorber, Heribert, & Werner Plesse (1968): 'Zur philosophischen und politischen Position des von Ernst Haeckel begründeten Monismus'. *Deutsche Zeitschrift für Philosophie* 16: 1325-1339.

Dove, Alfred (1871): 'Was macht Darwin populär?' *Im neuen Reich. Wochenschrift für das Leben des deutschen Volkes in Staat, Wissenschaft und Kunst*. 1.2: 1-6. Leipzig: Hirzel.
Drews, Artur (1908): *Der Monismus, dargestellt in Beiträgen seiner Vertreter*. Jena: Diederichs, 2 vols.
Dröscher, Ariane (1992): 'Die Auslandsstipendien der italienischen Regierung (1861-1894)'. *Annali dell'Istituto Storico Italo-Germanico in Trento* 18: 545-569.
— (1996): *Die Zellbiologie in Italien im 19. Jahrhundert*. Halle (Saale): Deutsche Akademie der Naturforscher Leopoldina, 1996 (=*Acta Historica Leopoldina* 26).
— (1998): 'La Cellularpathologie (1858) di Rudolf Virchow e il rinnovamento della medicina italiana nella seconda metà dell'Ottocento'. *Annali dell'Istituto Storico Italo-Germanico in Trento* 24: 87-112.
— (2002): *Le facoltà medico-chirurgiche italiane (1860 - 1915); repertorio delle cattedre e degli stabilimenti annessi, dei docenti, dei liberi docenti e del personale scientifico*. Bologna: CLUEB (=Studi / Centro Interuniversitario per la Storia delle Università Italiane 4)
— (2002a): 'Die Entwicklung biologischer Disziplinen an den italienischen Universitäten (1860-1900)', in: Hoßfeld, Uwe & Thomas Junker (eds.): *Die Entstehung biologischer Disziplinen II*. Berlin: VWB – Verlag für Wissenschaft und Bildung (=*Verhandlungen zur Geschichte und Theorie der Biologie*, vol. 9), pp. 39-53.
— (2002b): 'Edmund B. Wilson's *The Cell and Cell Theory* between 1896 and 1925'. *History and Philosophy of the Life Sciences* 24: 357-389.
— (2007): 'Rina Monti-Stella: a "Signora" Between Tradition and Innovation, in Babini & Simili (eds): *More Than Pupils*, pp. 125-148.
Du Bois-Reymond, Emil (1872): *Über die Grenzen des Naturerkennens*. Leipzig: Veit.
— (1881): *Die sieben Welträthsel*. Berlin: Vogt.
Duchesneau, François (1994): 'Kölliker and Schwann's Cell Theory', in Cimino, Guido, & Carlo Maccagni (ed.s, 1994): *La storia della medicina e della scienza tra archivio e laboratorio*. Florence: Olschki, pp. 103-121.
Dujardin, Félix (1841): *Histoire naturelle des zoophytes: infusoires*. Paris: Roret.
Dunant, Jean Henry (1862): *Un souvenir de Solferino*. Geneva: Fick.
Eatwell, Roger (1995): *Fascism. A History*. London: Chatto & Windus.
Ehrenberg, Christian Gottfried (1838): *Die Infusionsthierchen als vollkommene Organismen*. Leipzig: Voss.
Eisler, P. (1919): 'Ludwig Stieda'. *Leopoldina* 55: 21-24.
Elsberg, Louis (1877): 'On the Plastidule Hypothesis'. *Proceedings of the American Association for the Advancement of Science* 25: 178-187.
Elsner, Norbert (ed., 2000): *Das ungelöste Welträtsel. Frida von Uslar-Gleichen und Ernst Haeckel. Briefe und Tagebücher 1898-1903*. Göttingen: Wallstein.

Engelhardt, Dietrich von (1992): 'Rapporti scientifici fra Italia e Germania nel XVIII e XIX secolo'. *Annali dell'Istituto storico italo-germanico in Trento* 18: 457-482.
Engels, Eve-Marie (ed.): *Die Rezeption von Evolutionstheorien im 19. Jahrhundert.* Frankfurt am Main: Suhrkamp.
Enigk, Karl (1986): *Geschichte der Helminthologie.* Stuttgart: Fischer.
Ernster, Lars & Gottfried Schatz (1981): 'Mitochondria: A historical review'. *The Journal of Cell Biology* 91 (3.2): 227s-255s.
Evans, Sam Piercy (1985): 'Materiale paleobotanico inedito dallo scavo dell'Isola Virginia'. *Sibrium* 18: 51-59.
Facchini, Fiorenzo (1987): 'Giuseppe Sergi e lo studio delle antiche popolazioni italiche', in Mucciarelli, Giuseppe (ed.): *Giuseppe Sergi nella storia della psicologia e dell'antropologia in Italia.* Bologna: Pitagora, pp. 117-126.
Fallaize, E. N. (1920): 'Robert Munro, M.A., M.D., LL.D. Born July 21st, 1835; Died July 18, 1920'. *Man* 20: 153-154.
Farley, John (1972): The Spontaneous Generation Controversy (1700-1860): The Origin of Parasitic Worms. *J. Hist. Biol.* 5: 95-125
— (1972a): 'The Spontaneous Generation Controversy (1859-1880): British and German Reactions to the Problem of Abiogenesis'. *J. Hist. Biol.* 5 (2): 285-319.
— (1977): *The Spontaneous Generation Controversy from Descartes to Oparin.* Baltimore/London: Johns Hopkins UP [1974].
— (1978): 'The Political and Religious Background to the Work of Louis Pasteur'. *Annual Reviews of Microbiology* 32: 143-154
—, & Gerald L. Geison (1974): 'Science, Politics and Spontaneous Generation in Nineteenth-Century France: The Pasteur-Pouchet Debate'. *Bull. Hist. Med.* 48: 161-198.
Fedele, Francesco & Alberto Baldi (eds., 1988): *Alle origini dell'antropologia italiana.* Naples: Guida.
Fenizia, Carlo (1899): 'Un precursore napoletano dell'evoluzione. Pel Centenario del MDCCXCIX'. Padova: Prosperini [repr. from. *Atti Soc. Veneto-Trentina Scienze Naturali* ser 2, 4 (1)].
Ferngren, Gary B. (ed., 2002): *Science & Religion.* Baltimore: Johns Hopkins University Press.
Ferri, Monica (1992): *La Civiltà cattolica e l'evoluzionismo.* PhD thesis, Bologna.
Ferrini, R. (1884): *Sulle forme fondamentali dell'organismo* di G. Cattaneo, presentato da L. Maggi. *Rendiconti del R. Ist. Lomb.* ser 2, 17: 4pp.
Ficalbi, Eugenio (1914): 'Il senese F. C. Marmocchi evoluzionista predarwiniano'. *Atti della Società Italiana per il progresso delle scienze VII riunione.* Roma: Bertero 13 pp.
Finnegan, Diarmid A. (2004): 'The work of ice: glacial theory and scientific culture in early Victorian Edinburgh. *BJHS* 37(1):29-52.
Fiorentino, F. (1875): 'Die philosophische Bewegung Italiens seit 1860'. *Italia* 2: 1-56.

Fisher, John R. (1993): 'British Physicians and the Cattle Plague 1865-66'. *BHM* 67: 651-669.
Flemming, Walther (1891-1897): 'Zelle'. *Ergebnisse der Anatomie und Entwicklungsgeschichte*. 1 (1891): 43-82, 2 (1892): 37-82, 3 (1893): 24-131, 4 (1894): 355-457, 5 (1895): 233-382, 6 (1896): 184-284, 7 (1897): 403-485.
Florey, Ernst (1999): 'Das Unbewusste und das Unterbewusstsein als Grundkonzepte der Anatomie und Histologie des Nervensystems im 19. Jahrhundert: Von Bichat zu Freud'. *Theory in Biosciences* 118: 3-14.
Foa, Anna (1998): *Giordano Bruno*. Bologna: Mulino.
FOCUS: "Biography in the History of Science", in: *Isis* 97 (2006), pp. 302-329.
Fogazzaro, Antonio (1913): *Ascensioni umane*. Sesto S. Giovanni: Madella [Milan: Baldini/Castoldi 1899].
— (1977): *Ascensioni umane*. With an introduction by Paolo Rossi. Milan: Longanesi [1899].
— (1995): *Piccolo mondo antico*. Rome: Newton Compton [orig. Milan: Galli, 1895].
— (1996): *Piccolo mondo antico*. With an introduction and notes by Anna Maria Trepaoli. Perugia: Guerra [1895]
Foissner, Wilhelm (1996): 'How to become an unforgettable taxonomist: Christian Gottfried Ehrenberg evaluated', in Schlegel & Hausmann (eds): *Ehrenberg-Festschrift*, pp. 47-50.
Forti, Achille (1925): 'Giovanni Battista de Toni. Commemorazione'. *Atti R. Istituto Veneto di Scienze, lettere ed arti* 84: 127-180.
Forti Messina, Anna Lucia (1982): 'I medici condotti all'indomani dell'Unità', in Betri, M. L. & A. Gigli Marchetti (eds.): *Salute e classi lavoratrici in Italia dall'Unità al fascismo*, Milan: Angeli, pp. 663-697.
—, Anna Lucia (1984): 'I medici condotti e la professione del medico nell'Ottocento'. *Società e storia* 7 (23): 101-161.
Fox, Sidney W. & Klaus Dose (1977): *Molecular Evolution and the Origin of Life*. NY/Basel: Dekker.
Fraas, Eberhard (1889): 'Die Labyrinthodonten der schwäbischen Trias'. *Palaeontographica* 36: 1-158.
Frassetto, F[abio] (1905): 'In morte di Leopoldo Maggi (7 marzo 1905)'. *Atti della Società Romana di Antropologia* 11: pp. 321-328.
— (1905a): *I nuovi indirizzi e le premesse della odierna antropologia : Sergi, Maggi, De Giovanni, Lombroso : prolusione al corso di antropologia professato nella r. Università di Bologna nell'anno scolastico 1904-1905*. Città di Castello: Lapi.
— (^{2}1918): *Lezioni di antropologia* vol. 1. Milan: Hoepli.
Frigo, Gian Franco (2005): 'Scienza e nazionalità: Le *Osservazioni* di Roberto Ardigò al *Grundriss* di Wilhelm Wundt', in Frigo, Gian Franco & Olaf Breidbach (eds.): *Scienza e filosofia nel positivismo italiano e tedesco*. Padua: Poligrafo, pp. 89-122.
Fritsch-Dove, Regina (1991): *Die Darstellung des Klerus in der italienischen Erzählliteratur von der Proklamation des Königreichs Italien bis zu den*

Lateranverträgen (1861-1929). Bonn: Romanistischer Verlag (=Abhandlungen zur Sprache und Literatur 44).

Fumagalli, Giuseppe ([10]1980): *Chi l'ha detto?*. Milan: Hoepli.

Gadebusch Bondio, Maria Carla (1996): 'La tipologizzazione della donna deviante nella seconda metà dell'Ottocento: La prostituta, la criminale e la pazza', in Beretta, Marco e. al. (ed.s, 1996): *Per una storia critica della scienza*. Bologna: Cisalpino, pp. 283-314.

Gálvez, Antonio (1988): 'The Role of the French Academy of Sciences in the Clarification of the Issue of Spontaneous Generation in the Mid-Nineteenth Century'. *Annals of Science* 45: 345-365.

Garin, Eugenio (1966): *Storia della filosofia italiana*, vol. 3. Turin: Einaudi.

Garzia, Mino (1992): 'For the History of Sociological Analysis', in id. (ed.): *Rivista italiana di sociologia*. Reprint Bad Feilnbach: Schmidt Periodicals, separate pagination.

Gasc, Jean-Pierre (1996): 'Anatomie comparée'. In Tort, P. (ed.): *Dictionnaire*, 78-85.

Gasco, Francesco (1878): *Paolo Panceri. Commemorazione detta nell'adunanza straordinaria del 28 giugno 1877 al comitato medico ed all'Associazione dei naturalisti e medici di Napoli*. Napoli: De Angelis.

Gasman, Daniel (1971): *The Scientific Origins of National Socialism. Social Darwinism in Ernst Haeckel and the German Monist League*. London: Macdonald/New York: American Elsevier, 1971.

— (1998): *Haeckel's Monism and the Birth of Fascist Ideology*. New York: Lang.

— ([2]2004): *The Scientific Origins of National Socialism. With a new foreword by the author*. New Brunswick NJ: Transactions.

Gatti, Rossana (2001): *La giovinezza di Paolo Mantegazza nelle pagine del suo diario (1848-1858)*. PhD thesis Univ. Milan, Facoltà di Lettere e Filosofia.

Gaudry, Albert (1896): *Essai de paléontologie philosophique*. Paris: Masson.

Gegenbaur, Carl (1898): *Der vergleichenden Anatomie der Wirbelthiere erster Band*. Leipzig: Engelmann.

Geison, Gerald L. (1971): 'Dujardin, Félix', in *Dictionary of Scientific Biography*. New York: Scribner, vol. 4: 233-237.

— (1974): 'Pasteur, Louis', in *Dictionary of Scientific Biography*. New York: Scribner, vol. 10: 350-416.

— (1978): *Michael Foster and the Cambridge School of Physiology : the scientific enterprise in late Victorian society*. Princeton: Princeton University Press.

— (1981): 'Scientific Change, Emerging Specialties, and Research Schools'. *Hist. Sci.* 19: 20-40.

— (1993): "Research Schools and New Directions in the Historiography of Science", in idem & Holmes (eds.): *Research Schools,* pp. 227-238.

— (1995): *The Private Science of Louis Pasteur*. Princeton: Princeton University Press.

— & Frederic L. Holmes (eds., 1993): *Research Schools. OSIRIS* new ser. 8.

— & Manfred D. Laubichler (2001): 'The Varied Lives of Organisms: Variation in the Historiography of the Biological Sciences'. *Stud. Hist. Phil. Biol & Biomed. Sci.* 32:1-29.
Geoffroy Saint-Hilaire, Isidore (1859): *Histoire naturelle générale des règnes organiques*. Paris: Masson, vol. 2.
Geus, Armin (1987): *Johannes Ranke (1836-1916). Physiologe, Anthropologe und Prähistoriker*. Marburg/Lahn: Basilisken-Presse.
— (2007): 'Die Zelle: die Einheit der Lebewesen – Aus den Anfängen der Zellbiologie im 19. Jahrhundert', in Höxtermann, Ekkehard & Hartmut H. Hilger (eds.): *Lebenswissen.*, pp. 122-141.
Geymonat, Ludovico (1971): *Storia del pensiero filosofico e scientifico*. Torino: Einaudi.
Giacobini, Giacomo, & Gian Luigi Panattoni (eds, 1983): *Il Darwinismo in Italia. Testi di Filippo De Filippi, Michele Lessona, Paolo Mantegazza, Giovanni Canestrini*. Torino: UTET.
Giuffrida-Ruggeri, V. (1904): *La posizione del bregma nel cranio del „Pithecanthropus erectus" e la tendenza neo-monogenista in Germania*. Roma: Soc. Rom. Antr.
Glick, Thomas (ed. ²1988): *The Comparative Reception of Darwinism* [1974], With a New Preface. Chicago/London: University of Chicago Press.
Gliozzi, M. (1970): 'Giuseppe Balsamo-Crivelli'. *Dizionario Biografico degli Italiani* 5, pp. 621-622.
Gorini, Ilaria (2003): 'Le singolari virtù di una sorgente di montagna'. *Lombardia Nord-Ovest* 76.2: 63-66.
Govoni, Paola (2002): *Un pubblico per la scienza. La divulgazione scientifica nell'Italia in formazione*. Rome: Carocci.
Gradmann, Christoph (1996): 'Bazillen, Krankheit und Krieg. Bakteriologie und politische Sprache im deutschen Kaiserreich'. *Ber. Wissenschaftsgesch.* 19: 81-94.
— (2000): 'Invisible Enemies: Bacteriology and the Language of Politics in Imperial Germany'. *Science in Context* 13: 9-30.
— (2003): 'Nur Helden in weißen Kitteln? Anmerkungen zur medizinhistorischen Biographik in Deutschland', in Bödeker (ed.): *Biographie schreiben*, pp. 243-284.
Graßhoff, Gerd & Michael May (1995): 'Methodische Analyse wissenschaftlichen Entdeckens'. *Kognitionswissenschaft* 5: 51-67.
—, Robert Casties & Kärin Nickelsen (2000): *Zur Theorie des Experiments. Untersuchungen am Beispiel der Entdeckung des Harnstoffzyklus*. Bern: Institut für Philosophie (=*Studies in the History and Philosophy of Science, Educational Materials* 2).
Grassi, G[iovanni] B[attista] (1906): 'La Vita (ciò che sembra a un biologo)'. *Rivista d'Italia* 9 (6): 885-912.
— (1911): 'I progressi della biologia e delle sue applicazioni pratiche conseguiti in Italia nell'ultimo cinquantennio', in R. Accademia dei Lincei

(ed.): *Cinquanta anni di storia italiana*, vol. III. Milan: Hoepli (separate pagination).
Green, Mott T. (1982): *Geology in the Nineteenth Century. Changing views of a changing world.* Ithaca: Cornell UPr.
Gregory, Frederick (1977): *Scientific Materialism in Nineteenth Century Germany*. Dordrecht/Boston: Reidel.
Gregory XVI, Pope (1852): *Index librorum prohibitorum*. Mondovì (Cuneo): Rossi [1841].
Griffin, Roger (2007): *Modernism and Fascism. The Sense of a Beginning under Mussolini and Hitler*. Basingstoke: Palgrave Macmillan.
Groeben, Christiane (1985): 'Anton Dohrn - The Statesman of Darwinism'. *Biological Bulletin* 168 (suppl.): 4-25.
—& Irmgard Müller (ed., 1975): *The Naples Zoological Station at the Time of Anton Dohrn*. Cava dei Tirreni: Di Mauro.
Grottanelli, Vinigi (1977): 'Ethnology and/or Cultural Anthropology in Italy: Traditions and Developments'. *Current Anthropology* 18: 593-614.
Gruber, A. (1887): 'Die Frage nach dem Bestehen verschiedener Plasmaschichten im Weichkörper der Rhizopoden'. *Biologisches Centralblatt* 6:5-8.
Grünbein, Durs (2001): 'Das grandiose Bilderbuch – Über die Wiederentdeckung eines Jahrhundertwerks: Ernst Haeckels "Kunstformen der Natur"', in: Röder, Hendrik & Maren Ulbrich (eds): *Welträtsel und Lebenswunder. Der Biologe Ernst Haeckel (1834-1919).* Potsdam: vacat, pp. 13-17.
Guarnieri, Patrizia (1981): *La "Rivista Filosofica" (1899-1908). Conoscenza e valori nel neokantismo italiano*. Firenze: La Nuova Italia. (=*Biblioteca di cultura* 154).
— (1983): '"La Volpe e l'uva". Cultura scientifica e filosofia nel positivismo italiano'. *Physis* 25: 601-636.
— (1986): *Individualità difformi. La psichiatria antropologica di Enrico Morselli*. Milan: Angeli.
— (1987): 'Moritz Schiff (1823-96): Experimental Physiology and Noble Sentiment in Florence', in Rupke (ed.): *Vivisection in Historical Perspective*. London: Croom Helm, pp. 105-124.
Guderzo, Giulio (ed., 1995): *Fedi e culture in area padana tra Otto e Novecento*. (=*Annali di storia pavese* 22-23). Pavia: Provincia di Pavia.
Günther, Hans (1956): 'Die überzähligen Knochen des Hirnschädels'. *Virchows Archiv* 328:102-110.
Haeckel, Ernst (1862): *Die Radiolarien (Rhizopoda radiaria), eine Monographie*. Berlin: Reimer.
— (1866): *Generelle Morphologie der Organismen*. 2 vols. Berlin: Reimer.
— (1868): *Natürliche Schöpfungsgeschichte*. Berlin: Reimer.
— (1870): *Biologische Studien*. Leipzig: Engelmann/Jena: Dufft.
— (1872): *Die Kalkschwämme*. 3 vols. Berlin: Reimer.

— (1873): 'Zur Morphologie der Infusorien'. *Jenaische Zeitschrift für Medizin und Naturwissenschaft* 7: 516-560.
— (1876): *Die Perigenesis der Plastidule oder die Wellenzeugung der Lebenstheilchen*. Berlin: Reimer.
— (1876a): *The History of Creation or the Development of the Earth and Its Inhabitants by the Action of Natural Causes*, translated by E. Ray Lankester, 2 vols. London: King.
— (1877): *Studien zur Gasträa-Theorie I+II*. Jena: Dufft [Repr. no date, Jena/Erlangen: Mayer].
— (1878): *Das Protistenreich*. Leipzig: Günther.
— (1878a): 'Zellseelen und Seelenzellen'. *Deutsche Rundschau* 16 (July-Sept.): 40-59.
— (1899): *Die Welträthsel*. Bonn: Emil Strauss.
— (1921): *Italienfahrt. Briefe an die Braut 1859/1860*. Leipzig: Koehler.
Hallier, Ernst (1867): *Gährungserscheinungen*. Leipzig: Engelmann.
Harris, Henry (2002): *Things come to Life. Spontaneous generation revisited*. Oxford: Oxford University Press.
Hausmann, Klaus (1996): Christian Gottfried Ehrenbergs „Vollkommene Organismen"', in Schlegel, Martin & Klaus Hausmann (ed.): *Ehrenberg-Festschrift*, pp. 51-62.
Hawkins, Mike (1997): *Social Darwinism in European and American Thought 1860-1945. Nature as model and nature as threat*. Cambridge: CUP.
Heider, Karl (1919): 'Ernst Haeckel. Ein Wort der Erinnerung'. *Die Naturwissenschaften* 17: 945f.
Heie, Nolan (2008): *Ernst Haeckel and the Redemption of Nature*. PhD thesis, Queen's University, Kingston ON, Canada, https://qspace.library.queensu.ca/bitstream/1974/1016/1/Heie_Nolan_D_200801_PhD.pdf [last accessed 11 Nov, 2010].
Heischkel, Edith (1956): 'Italienreisen deutscher Ärzte im 19. Jahrhundert'. *Sudhoffs Archiv* 40: 295-304.
Hertwig, Oscar (1918): *Zur Abwehr des ethischen, des sozialen, des politischen Darwinismus*. Jena: Fischer.
Hertwig, Richard (1919): 'Haeckels Verdienste um die Zoologie'. *Die Naturwissenschaften* 17: 951-958.
Hillermann, H[orst], & A. Hügli. (1984): 'Monismus', in *Historisches Wörterbuch der Philosophie* 6: col. 132-138.
— (1976): *Der vereinsmäßige Zusammenschluß bürgerlich-weltanschaulicher Reformvernunft in der Monismusbewegung des 19. Jahrhunderts*. Kastellaun: Henn.
— (1976a): 'Zur Begriffsgeschichte von „Monismus"'. *Arch. Begriffsgeschichte* 20: 214-235
Hobsbawm, E[ric] J. (1990): *Nations and nationalism since 1780. Programme, myth, reality*. Cambridge: CUP.
—. & Terence O. Ranger (eds., 1983): *The Invention of Tradition*. Cambridge: CUP.

Hodge, Jonathan & Gregory Radick (eds., 2003): *The Cambridge Companion to Darwin*. Cambridge: CUP.

Holmes, Frederic L. (1963): 'The milieu interieur and the cell theory'. *Bull. Hist. Med.* 37: 315-335.

— (1990): 'Laboratory Notebooks: Can the Daily Record Illuminate the Broader Picture?' *Proceedings of the American Philosophical Society* 134: 349-366.

— (1991-1993): *Hans Krebs*. 2 vols. New York: Oxford University Press.

— (1993): 'Preface [to "Research Schools"]'. *Osiris* 8: vii-viii.

Holmes, S. J. (1948): 'Micromerism in Biological Theory'. *Isis* 39: 145-158.

Holt, Niles R. (1971): 'Ernst Haeckel's Monistic Religion'. *J. Hist. Ideas* 32 (2): 265-280.

Hörz, Herbert, e.al. (^{3}1991): *Philosophie und Naturwissenschaften. Wörterbuch zu den philosophischen Fragen der Naturwissenschaft*. Wiesbaden: fourier.

Hoßfeld, Uwe (2005): *Geschichte der biologischen Anthropologie in Deutschland – Von den Anfängen bis in die Nachkriegszeit*. Stuttgart: Steiner.

— (2005a): '"Etica monistica" in Heinrich Schmidt', in Frigo, Gian Franco & Olaf Breidbach (eds.): *Scienza e filosofia nel positivismo italiano e tedesco*. Padua: Poligrafo, pp. 167-185.

— & Lennart Olsson (2003): 'The Road from Haeckel'. *Biology and Philosophy* 18:285-307.

— & Olaf Breidbach (2005): *Haeckel-Korrespondenz: Übersicht über den Briefbestand des Ernst-Haeckel-Archivs*. Berlin: VWB – Verlag für Wissenschaft und Bildung, 2005 (Ernst-Haeckel-Haus-Studien 9).

— & Olaf Breidbach (2006): 'In the wake of the "Darwin Correspondence". 40.000 letters to Ernst Haeckel listed and available for study'. *Annals of the History and Philosophy of Biology* 10: 55-58.

Höxtermann, Ekkehard (1998): 'Konstantin S. Merezkovskij und die Symbiogenesetheorie der Zellevolution', in Geus, Armin (ed.): *Bakterienlicht und Wurzelpilz*. Marburg: Basilisken-Presse, pp. 11-29.

— & Hartmut H. Hilger (eds., 2007): *Lebenswissen. Eine Einführung in die Geschichte der Biologie*. Rangsdorf (Brandenburg): Natur & Text.

Hughes, Arthur (1959): *A History of Cytology*. London, New York: Abelard & Schuman.

ICZN (International Commission on Zoological Nomenclature) (2007): *Official Lists and Indexes of Names in Zoology*, http://www.iczn.org/lists&indexes.pdf, acc. May 2008.

Isella, Dante (1984): *I Lombardi in rivolta. Da Carlo Maria Maggi a Carlo Emilio Gadda*. Turin: Einaudi [reprint 2002].

Jacobs, Natasha X. (1989): 'From Unit to Unity: Protozoology, Cell Theory, and the New Concept of Life'. *Journal of the History of Biology* 22:215-242.

Jahn, Ilse (1971): 'Ehrenberg, Christian Gottfried'. *Dictionary of Scientific Biography*. New York: Scribner, vol. 4: 288-292.

— (ed. ²2003): *Klassische Schriften zur Zellenlehre von Matthias Jacob Schleiden, Theodor Schwann, Max Schultze*. 2nd ed. revised. Frankfurt am Main: Harri Deutsch [1987 Leipzig: Geest & Portig].
— (2003a): 'Einführung und Erläuterung zur Geschichte der Zellenlehre und der Zellentheorie', in eadem (ed.): *Klassische Schriften*, pp. 6-44.
— (1991): 'The influence of Jakob Friedrich Fries on Matthias Schleiden', in Woodward, William R. & Robert S. Cohen (eds.): *World views and scientific discipline formation*. Dordrecht: Kluwer, p.357-365.
— (³2000): *Geschichte der Biologie*. Heidelberg/Berlin: Spektrum.
Junker, Thomas (1993): 'Albert Wigands *Genealogie der Urzellen* und [die] Darwinsche Revolution'. *Biologisches Zentralblatt* 112: 207-214.
— (1994): 'Historiographische Reflexionen zur „Darwin-Industrie": Kreativität, wissenschaftliches Milieu, Transformation, Diversifikation und Klassifikation'. *Jahrbuch f. Geschichte und Theorie der Biologie* 1: 45-68.
Kallensee, Frank (2001): 'Walter Ulbricht lädt zur Lektüre – „Die Welträtsel" als sozialistisches Hausbuch in der frühen DDR', in Röder, Hendrik & Maren Ulbrich (eds): *Welträtsel und Lebenswunder. Der Biologe Ernst Haeckel (1834-1919)*. Potsdam: vacat, pp. 66-69.
Kanz, Kai Torsten (1997): 'Naturgeschichte und wissenschaftliche Kommunikation. Aspekte der Italienreisen deutscher Naturforscher im späten 18. Jahrhundert'. *Il Confronto Letterario* 25 (suppl.): 23-41.
Kaupen-Haas, Heidrun, & Christian Saller (eds, 1999): *Wissenschaftlicher Rassismus. Analysen einer Kontinuität in den Human- und Naturwissenschaften*. Frankfurt am Main: Campus.
Keitel-Holz, Klaus (1984): *Ernst Haeckel. Forscher - Künstler - Mensch. Eine Biographie*. Ffm: R.G.Fischer.
Keller, Evelyn Fox (1990): 'Physics and the Emergence of Molecular Biology'. *Journal of the History of Biology* 23: 389-409.
Kelly, Alfred (1981): *The Descent of Darwin. The Popularization of Darwinism in Germany, 1860-1914*. Chapel Hill: University of North Carolina Pr.
Keosian, John (1972): 'The Origin of Life Problem - A Brief Critique', in Rohlfing, Duane L. & A. I. Oparin (eds.): *Molecular Evolution. Prebiological and Biological*. NY/London: Plenum, pp. 9-21.
Klebs, Edwin (1877): *Studien über die Verbreitung des Cretinismus in Österreich sowie über die Ursache der Kropfbildung*. Prague: Dominicus.
Kleeberg, Bernhard (2005): *Theophysis. Ernst Haeckels Philosophie des Naturganzen*. Köln: Böhlau.
Klimke, Friedrich, S.J. (1911): *Der Monismus und seine philosophischen Grundlagen*. Freiburg im Breisgau: Herder.
Kockerbeck, Christoph (1986): *Ernst Haeckels „Kunstformen der Natur" und ihr Einfluss auf die deutsche bildende Kunst der Jahrhundertwende: Studie zum Verhältnis von Kunst und Naturwissenschaft im Wilhelminischen Zeitalter*. Frankfurt am Main: Lang.

— (1999): *Carl Vogt - Jacob Moleschott - Ludwig Büchner - Ernst Haeckel, Briefwechsel*. Marburg: Basilisken-Presse.
Koerner, Konrad (1987): 'On Schleicher and Trees', in Hoenigswald, Henry M., & Linda F. Wiener (ed.s): *Biological Metaphor and Cladistic Classification. An Interdisciplinary Perspective*. London: Frances Pinter, pp. 109-113.
Köhler, Werner (2000): 'Entwicklung der Mikrobiologie mit besonderer Berücksichtigung der medizinischen Aspekte', in Jahn, Ilse (ed.): *Geschichte der Biologie*. Berlin: Spektrum (orig. Jena: Fischer, [3]1998).
Kohn, David (ed., 1985): *The Darwinian Heritage*. Princeton: PrUP.
Kolkenbrock-Netz, Jutta (1991): 'Wissenschaft als nationaler Mythos. Anmerkungen zur Haeckel-Virchow-Kontroverse auf der 50. Jahresversammlung deutscher Naturforscher und Ärzte in München (1877)', in Link, Jürgen, & Wulf Wülfing (eds): *Nationale Mythen und Symbole in der zweiten Hälfte des 19. Jahrhunderts*. Stuttgart: Klett-Cotta, pp. 212-236.
Krauße, Erika & Uwe Hoßfeld (1999): 'Das Ernst-Haeckel-Haus in Jena. Von der privaten Stiftung zum Universitätsinstitut (1912-1979)', in Geus, Armin et al. (eds.): *Repräsentationsformen in den biologischen Wissenschaften*. Berlin: VWG, pp. 203-231 (= *Verhandlungen zur Geschichte und Theorie der Biologie* 3).
— ([2]1987): *Ernst Haeckel*. Leipzig: Teubner [1984].
— (1991): 'Zur Frage der Schulenbildung bei Ernst Haeckel (1834-1919)', in: Stolz, Rüdiger (ed.): *Wissenschaft und Schulenbildung*. Jena: Universitätsverlag, pp. 184-194.
— (1992): 'Johannes Müller und Ernst Haeckel', in: Hagner, Michael & Bettina Wahrig-Schmidt (eds.): *Johannes Müller und die Philosophie*. Berlin: Akademie-Verlag, pp. 223-237.
— (1993): 'Haeckel e l'Italia/ Haeckel und Italien', in: CISST (ed.): *Haeckel e l'Italia*, pp. 59-77.
— (1997): 'Wissenschaftliche Weltauffassung – wissenschaftliche Weltgestaltung – Wissenschaftsreligion. Wilhelm Ostwald (1853-1932) und der Monistenbund'. *Mitteilungen der Wilhelm-Ostwald-Gesellschaft* 2: 45-68.
— (2001): Im Einsatz für das Wahre, Gute und Schöne – Zur Biographie Ernst Haeckels (1834-1919), in: Röder, Hendrik & Maren Ulbrich (eds): *Welträtsel und Lebenswunder. Der Biologe Ernst Haeckel (1834-1919)*. Potsdam: vacat, pp. 38-49.
Krumbach, Thilo (1919): 'Die Schriften Ernst Haeckels'. *Die Naturwissenschaften* 17: 961-966.
— (1919a): 'Ernst Haeckels Person und Werk im Urteil der Zeitgenossen'. *Die Naturwissenschaften* 17: 966-971.
Lacaita, Carlo G. (ed., 2000): *Scienza tecnica e modernizzazione in Italia fra otto e novecento*. Milan: Franco Angeli.
Labanca, Nicola (1993): *In marcia verso Adua*. Turin: Einaudi.

Lamarck, Jean-Baptiste de (1809): *Philosophie zoologique*. Paris: Dentu.
Landucci, Giovanni (1977): *Darwinismo a Firenze. Tra scienza e ideologia (1860-1900)*. Florence: Olschki.
— (1985): 'Paolo Mantegazza e la cultura del suo tempo'. *Antropologia contemporanea* 8 (1): 5-18.
— (1987): *L'occhio e la mente. Scienza e filosofia nell'Italia del secondo Ottocento*. Florence: Olschki.
— (1988): 'Mantegazza e Nicolucci', in Fedele & Baldi (eds): *Alle origini*, pp. 61-83.
— (1992): 'Darwinisme et nationalisme en Italie', in Tort (ed. 1992): *Darwinisme et société*. Paris: Press univ. de France, pp. 285-351.
— (1996): 'Darwinisme italien/Italian Darwinism', in Tort (ed. 1996): *Dictionnaire*, pp. 954-1041.
— (1996a): 'Maggi Leopoldo 1840-1905', in: Tort (ed.): *Dictionnaire*, pp. 2757-2759.
— (1996b): 'Mantegazza Paolo 1828-1911', in: Tort (ed.): *Dictionnaire*, pp. 2797-2803.
— (1996 s.v.): entries other than the three above, in Tort, Patrick (ed.): *Dictionnaire*, pp. in citations.
Largaiolli, Vittorio (1900): 'Giovanni Canestrini', in *Bollettino della Società degli studenti trentini* 2 (4): 25-35
Latour, Bruno (1992): 'Pasteur on Lactic Acid Yeast: A Partial Semiotic Analysis'. *Configurations* 1: 129-145.
— (1997): 'Pasteur et Pouchet: hétérogenèse de l'histoire des sciences', in: Serres, Michel: *Eléments d'histoire des sciences*, Paris: Larousse, pp. 629-663 [orig.: Bordas, 1989, pp. 423-445].
— (2001): *Pasteur: guerre et paix des microbes suivi de Irréductions*. Paris: La Découverte & Syros [orig.: *Les microbes: Guerre et paix*. Paris: Métailié, 1984].
La Vergata, Antonello (1982): 'Biologia, scienze umane e "darwinismo sociale". Considerazioni contro una categoria storiograficamente dannosa'. *Intersezioni* 2: 77-97.
— (1994): 'Evolution and War, 1871-1918'. *Nuncius* 9: 143-163.
— (1995): 'Introduzione: storia e storie di scienziati', in id. (ed.): *Le biografie scientifiche. Intersezioni* 15 (1): 3-20.
— (ed. 1995): *Le biografie scientifiche. Intersezioni* 15 (1) (special issue).
— (2001): 'Introduction', in: Rosa, Daniele: *Ologenesi*. Florence: Giunti [1918].
Lawrence, Christopher & Richard Dixey (1992): 'Practicing on principle: Joseph Lister and the germ theories of disease', in Lawrence, Christopher (eds.): *Medical Theory, Surgical Practice: Studies in the History of Surgery*. NY: Routledge, pp. 153-215.
Lechevalier, Hubert & Morris Solotorovsky (1965): *Three Centuries of Microbiology*. New York: McGraw-Hill.

Leclerc, [Léon] (1815): 'Note sur la difflugie, nouveau genre de polype amorphe'. *Mémoires du Muséum d'histoire naturelle* 2: 474-478, plate 17.
Lenay, Charles (1997): 'Ernst Haeckel', in: Ambrière, Madeleine (ed.): *Dictionnaire du XIXe siècle européen*. Paris: PUF, pp. 519-520.
Lenoir, Timothy (1987): 'Essay Review: The Darwin Industry'. *Journal of the History of Biology* 20 (1): 115-130.
Lenz, Arnher E. & Volker Mueller (eds., 2006): *Darwin, Haeckel und die Folgen*. Neustadt a. Rbb.: A. Lenz.
Leonardi, Piero (1982): *Ricordando Carlo Darwin nel primo centenario della sua morte*. Trieste: Museo civico di Storia naturale.
Leone, Alba Rosa (1985): 'La chiesa, i cattolici e le scienze dell'uomo: 1860-1960', in P. Clemente, A.R. Leone, & S. Puccini (eds.): *L'antropologia italiana, un secolo di storia*. Bari: Laterza (=Biblioteca di Cultura Moderna 920), pp. 51-96.
Lepenies, Wolf (1994): 'La traducibilità delle culture. Un problema europeo, una opportunità per l'Europa'. *Intersezioni* 14 (1): 5-19.
Lessona, Michele (1867): 'Filippo De Filippi'. *Nuova Antologia* 6: 631-660.
— (1892): 'Ernesto Haeckel'. Prefazione a: Haeckel, Ernesto. *Opere* 1: *Storia della creazione naturale*, transl. D. Rosa, pp. 1-4.
Lester, Joseph (1995): *E. Ray Lankester and the Making of Modern British Biology*. n.l.: British Society for the History of Science, chap. 7: The Anatomist and Evolutionist, pp. 79-91.
Leuret, François & Pierre Gratiolet (1857): *Du système nerveux considéré dans ses rapports avec l'intelligence*. Vol. 2, Paris: Baillière.
Lill, Rudolf (1988): *Geschichte Italiens in der Neuzeit*. Darmstadt: wbg.
— & F. Traniello (eds 1992): *Il "Kulturkampf" in Italia e nei paesi di lingua tedesca*. Bologna: Mulino.
Linguerri, Sandra (2007): 'Giovanni Battista Grassi, Anna Foà and the Story of the Stone Carver', in Babini & Simili (eds.): *More Than Pupils*, pp. 159-181.
Lioy, Paolo (1902): 'Commemorazione di Giovanni Canestrini'. *Atti R. Istituto Veneto di Scienze, lettere ed arti* 62 (1): 45-67.
Lovett, Clara Maria (1972): *Carlo Cattaneo and the politics of the risorgimento, 1820 – 1860*. The Hague: Nijhoff.
Lucatello, Luigi (1924): 'Achille de Giovanni. Commemorazione'. *Atti R. Istituto Veneto di Scienze, lettere ed arti* 84 (1): 62-81.
Lyttelton, Adrian (1976): 'Italian Fascism', in Laqueur, Walter (ed.): *Fascism. A Reader's Guide*. Berkeley/LA: Univ. Cal. Pr, pp. 125-150.
— (2001): 'Creating a National Past: History, Myth and Image in the Risorgimento', in Ascoli, Albert Russell & Krystyna von Henneberg (eds.): *Making and Remaking Italy. The Cultivation of National Identity around the Risorgimento*. Oxford/NY: Berg, pp. 27-74.
Maggi, Leopoldo: References in the text are given in the format "M000", the number referring to the entry in his own printed bibliography of 1901, updated in his handwriting, copy in the library of the *Istituto di Anatomia e*

fisiologia comparate, University of Pavia; reproduced with additions and corrections at the end of this bibliography.
— (1900): *Appunti di Anatomia e Fisiologia comparate*. [lithographed hand-written notes of Maggi's lectures, collected by G. Marian, E. Repossi, A. Gnocchi, G.B. Traverso. Pavia: Bruni
— (1901): *Anatomia e Fisiologia comparate* [lithographed hand-written notes of Maggi's lectures, collected by E. Bravetta]. Pavia: Bruni.
Maggi, Luigi (1906): *Il positivismo naturale*. Roma: Moderna.
Maienschein, Jane (1994): 'It's a Long Way From *Amphioxus*. Anton Dohrn and Late Nineteenth Century Debates About Vertebrate Origins'. *Hist. Phil. Life Sci.* 16: 465-478.
— (2007): 'To Evo-Devo Through Cells, Embryos, and Morphogenesis', in Laubichler, Manfred D. & Jane Maienschein (eds.): From Embryology to Evo-Devo: A History of Developmental Evolution. Cambridge MA: MIT Press, pp. 109-121.
Maiocchi, Roberto (1996): 'Scienza italiana e razzismo fascista: La demografia di Corrado Gini', in Beretta, Marco e. al. (eds.): *Per una storia critica della scienza*. Bologna: Cisalpino, 347-370.
— (1999): *Scienza italiana e razzismo fascista*. Scandizzi: La Nuova Italia.
Malacrida, G.: (1875): *Intorno ad una gita geologica nel territorio di Varese, fatta da una comitiva di studenti di storia naturale all'Università di Pavia*. Pavia: Bizzoni.
Mangoni, Luisa (1985): *Una crisi fine secolo*. Torino: Einaudi.
Mann, Gunter (1980): 'Ernst Haeckel und der Darwinismus: Popularisierung, Propaganda und Ideologisierung'. *Medizinhistorisches Journal* 15: 269-283.
Mantegazza, Paolo (1852): 'Ricerche sulla generazione degli infusorii, e descrizione di alcune nuove specie'. *Giornale dell'I. R. Istituto lombardo di scienze, lettere ed arti* 3 (front date 1851): 467-491.
— (1864): 'Sulla generazione spontanea. Note sperimentali.' *Il Politecnico* 21: 101-125.
— (1864a): 'Sulla generazione spontanea. Note sperimentali (estratto)'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali* 1: 8-14.
— (1865): 'Sui corpuscoli semoventi'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali* 2: 23-25.
— (1868): 'Carlo Darwin e il suo ultimo libro'. *Nuova Antologia* 8: 70-98.
M[antegazza, Paolo] (1905): 'Rivista: Fabio Frassetto. – I nuovi indirizzi e le promesse dell'odierna antropologia. Sergi, Maggi, De Giovanni, Lombroso'. *Archivio per l'antropologia e la etnologia* 35: 92-93.
— (1905a): 'Commemorazione del Prof. Leopoldo Maggi'. *Archivio per l'antropologia e la etnologia* 35: 439.
— (with [Giovanni] Cantoni) (1865): 'Di alcune esperienze sull'eterogenia in vasi chisi e con sostanze bollite, ad atmosfera arroventata'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali* 2: 264-267.

— & A. Zanetti (1874): 'I due Akka del Miani'. *Archivio per l'Antropologia e l'Etnologia* 4: 137-163.
Manzi, Giorgio (1987): 'Il Museo di Antropologia dell'Università "La Sapienza" di Roma: una testimonianza del percorso intellettuale di Giuseppe Sergi nella seconda metà del XIX secolo', in Mucciarelli, Giuseppe (ed.): *Giuseppe Sergi nella storia della psicologia e dell'antropologia in Italia*. Bologna: Pitagora, pp. 127-137.
Martin, William & Klaus V. Kowallik (1999): 'Annotated English translation of Mereschkowsky's 1905 paper "Über Natur und Ursprung der Chromatophoren im Pflanzenreiche"'. *European Journal of Phycology* 34: 287-295.
Martucci, Vittorio (1981): 'Il discusso fascino di una ipotesi: la pangenesi di Darwin e gli studiosi italiani 1868-1888'. *History and Philosophy of the Life Sciences* 3: 243-257.
Mauthner, Fritz (1911): 'Monismus', in: *Wörterbuch der Philosophie*. 2, pp. 97-112.
Mazzarello, Paolo (1996): *La struttura nascosta. La vita di Camillo Golgi*. Milano: Cisalpino, 1996 (=*Fonti e studi per la storia dell'Università di Pavia* 26).
— (1996a): Ottorino Rossi and the Medical Tradition of Pavia. *Journal of the History of the Neurosciences* 5: 162-168.
— (1999): *The Hidden Structure: a scientific biography of Camillo Golgi*. Oxford: Oxford University Press (translation of Mazarello 1996 by A. Buchtel & Aldo Badiani).
— (2003): 'La scuola scientifica di Camillo Golgi'. *Annali di Storia delle Università italiane* 7, online unpaginated: http://www.cisui.unibo.it/annali/07/testi/10Mazzarello_frameset.htm (last acc. May 2008).
Mazzi, Valdo (1988): 'Il contributo dell'Accademia allo sviluppo delle scienze biologiche animali'. *Atti AdS TO Cl. SFMN* 121, *Suppl.*: 145-156
Mazzolini, Renato G. (1988): *Politisch-biologische Analogien im Frühwerk Rudolph Virchows*. Marburg: Basilisken-Presse.
— (1983): 'Stato e organismo, individui e cellule nell'opera di Rudolf Virchov negli anni 1845-1860'. *Annali dell'Istituto Storico italo-germanico in Trento* 9:153-193.
McLaughlin, Peter (2006): 'Spontaneous versus Equivocal Generation in Early Modern Science'. *Annals of the History and Philosophy of Biology* 10 (2005): 79-88.
Mendelsohn, J. Andrew (2003): 'Lives of the Cell'. *Journal of the History of Biology* 36:1-37.
Menozzi, Daniele (2007): 'I gesuiti, Pio IX e la nazione italiana', in Banti, Alberto Mario & Paul Ginsborg (eds): *Storia d'Italia. Annali 22: Il Risorgimento*. Turin: Einaudi, pp. 451-478.
Mereschkowsky, C[onstantin S.] (1905): 'Über Natur und Ursprung der Chromatophoren im Pflanzenreiche'. *Biologisches Centralblatt* 25: 593-604, 689-691.

Meschiari, A. (1990): 'Critica della filosofia zoologica per Battista Grassi'. *Giornale critico della filosofia italiana* 3: 366-383.
Michaelis, Meir (1978): *Mussolini and the Jews. German-Italian Relations and the Jewish Question in Italy 1922-1945*. Oxford: Clarendon.
Migutsch, Christian (2003): 'On Carl Gegenbaur's theory on head metamerism and the selection of taxa for comparisons'. *Theory in Biosciences* 122: 204-229.
Milani, Riccardo (1995): 'Zoologi e biologi a Pavia in età positivistica'. *Annali di Storia Pavese* 22-23:413-430.
Mikulinskij, Semen R. (1977-79): *Wissenschaftliche Schulen*. 2 vols. Berlin: Akademie Verlag.
Miles, Sara Joan (1989): 'Clémence Royer et *De l'origine des espèces*: Traductrice ou traîtresse?' *Revue de synthèse* 4th ser. 1: 61-83.
Milne Edwards, H[enri] (1863): *Leçons sur la physiologie et l'anatomie comparée de l'homme et des animaux*, vol. 8. Paris: Masson.
Milza, Pierre (1985): *Les Fascismes*. Paris: Impr. Nationale.
Minazzi, Fabio, & Luigi Zanzi (eds., 1987): *La scienza tra filosofia e storia in Italia nel Novecento. Atti del congresso internazionale, Varese 24-26.Okt. 1985*. Rome: Presidenza del Consiglio dei Ministri.
Minelli, Alessandro & Sandra Casellato (eds., 2001): *Giovanni Canestrini, Zoologist and Darwinist*. Venice: Istituto Veneto di Scienze, Lettere ed Arti.
Miozzi, Umberto Massimo (1993): *Lo sviluppo storico dell'università italiana*. Florence: Monnier.
Mitchell, Peter Chalmers (1930): *Materialism and Vitalism in Biology*. Oxford: Clarendon.
Moe, Nelson (2001): '"This is Africa": Ruling and Representing Southern Italy, 1860-61', in Ascoli, Albert Russell & Krystyna von Henneberg (eds.): *Making and Remaking Italy. The Cultivation of National Identity around the Risorgimento*. Oxford/NY: Berg, pp. 119-153.
Moggi-Cecchi, Jacopo (1988): 'Lidio Cipriani'. *Antropologia contemporanea* 11 (1-2): 81-84.
Molari, Carlo (1984): *Darwinismo e teologia cattolica*. Rome: Borla.
— (1984a): 'La teologia cattolica di fronte all'evoluzionismo darwinista ieri ed oggi', in Ghiara, Gianfranco (ed.): *Il Darwinismo nel pensiero scientifico contemporaneo*. Napoli: Guida, pp. 217-296.
Moleschott, Jacob (1852): *Der Kreislauf des Lebens*. Mainz: Zabern.
Moleschott, Jacopo (1869): *La circolazione della vita* (transl. of the 4th German ed. by Cesare Lombroso). Milan: Brigola.
Mollenhauer, Dieter (2007): 'Die Vielfalt: die Formen der Lebewesen – Morphologie und Systematik und ihre Geschichte', in Höxtermann, Ekkehard & Hartmut H. Hilger (eds.): *Lebenswissen*, pp. 257-307.
Mondella, Felice (1980): 'Giuseppe Sergi: La sconfitta di uno psicologo materialista'. *Quaderni di Storia e critica della scienza* 9. Pisa: Domus Galilaeana, pp. 41-53.

— (1982): 'Vita e intelligenza nella psicologia evoluzionistica di Spencer', in Santucci (ed.): *Scienza e filosofia nella cultura positivistica*. Milan: Feltrinelli.
— (1996): 'Preformismo ed eredità biologica nella seconda metà dell'Ottocento', in: Beretta, Marco e. al. (eds.): *Per una storia critica della scienza*. Bologna: Cisalpino, pp. 395-404.
Montalenti, Giuseppe (1983) 'Il darwinismo in Italia'. *Belfagor* 38: 65-78.
— & Paolo Rossi (eds 1982): *Lazzaro Spallanzani e la biologia del settecento*. Florence: Olschki.
Montanelli, Indro (1977): *L'Italia dei notabili*. Milan: Rizzoli.
Monti, Achille (1900): *The Fundamental Data of Modern Pathology. History, Criticisms, Comparisons, Applications*. Transl. with author's additions by John Joseph Eyre. London: The New Sydenham Society. [*I dati fondamentali della patologia moderna : storia, critica, raffronti, applicazioni*. Turin: Rosenberg & Sellier, 1898].
Monti, Maria Teresa (1983): 'Filosofia e scienza nella "Rivista di filosofia scientifica" (1881-1891)'. *Rivista critica di storia della filosofia* 38: 409-440.
Monti, Rina (1899): 'I protisti delle risaje. Nota 1a'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti* ser. 2 32: 159-164.
— (1899a): 'L'eteromorfosi nei dendroceli d'acqua dolce ed in particolare nella "Planaria alpina"'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti* ser. 2 32: 1314-1321.
— (1899b): 'Sulle ghiandole salivari dei gasteropodi terrestri nei diversi periodi funzionali'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti* ser. 2 32: 534-5 (adunanza del 23 Marzo).
Moore, James, Giuliano Pancaldi & Adrian Desmond (1995): 'Scrivere la biografia di Darwin', in La Vergata (ed.): *Le biografie scientifiche. Intersezioni* 15: 131-139.
Morselli, Enrico (1892): 'Il darwinismo e l'evoluzionismo'. *Rivista di filosofia scientifica* 10: 709-746.
— (1904): 'Sulla Filosofia monistica in Italia. Introduzione', in Haeckel, Ernesto: *I problemi dell'universo* (transl.: Amedeo Herlitzka). Torino: UTET, pp. VII-XLIII.
— (1906): 'Cesare Lombroso e la filosofia scientifica', in: Anon. (ed.): *L'opera di Cesare Lombroso nella Scienza e nelle sue applicazioni*. Torino: Bocca, pp. 354-384.
Moscati, Pietro (1770): *Delle corporee differenze che passano fra la struttura de' bruti, e la umana*. Milan: Galeazzi.
Müller, Irmgard (1976): *Die Geschichte der Zoologischen Station in Neapel von der Gründung durch Anton Dohrn (1872) bis zum Ersten Weltkrieg und ihre Bedeutung für die Entwicklung der modernen biologischen Wissenschaften*. Düsseldorf: Heinrich-Heine-Universität (habilitation thesis).
Müller, Rudolf (1897): *Entstehungsgeschichte des Roten Kreuzes und der Genfer Konvention*. Stuttgart: Greiner & Pfeiffer.
Munro, Robert (1890): *The Lake-Dwellings of Europe*. London: Cassell.

Murani, Oreste (1899): 'Commemorazione del Sen. Prof. Giovanni Cantoni', in *Rendiconti. Reale Istituto Lombardo di Scienze e Lettere* ser. 2 32: 57-107.
Mussolini, Benito (1951): 'Centenario Darwiniano', in *Opera omnia* (ed. E. & D. Susmel), vol. 2 [1909] Florence: Fenice.
Nardi, Piero (1938): *Antonio Fogazzaro*. Milan: Mondadori.
Nese, Marco (1993): *Soziologie und Positivismus im präfaschistischen Italien 1870-1922*. Basel: Birkhäuser.
Niewöhner, Friedrich (1980): 'Zum Begriff „Monismus" bei Haeckel und Ostwald'. *Archiv für Begriffsgeschichte* 24: 123-126.
Nomine [nominations] (1866): 'Pasteur e Pouchet, 25 Gennajo 1866'. *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, Classe di scienze matematiche e naturali* 3: 41.
Numbers, Ronald L. (2007): 'Epilogue: Science, Secularization, and Privatization', in Rupke (ed.): *Eminent Lives…*, pp. 235-248.
Nye, Mary Jo (2006): 'Scientific Biography: History of Science by Another Means?' *Isis* 97: 322-329.
Nyhard, Lynn K. (1987): 'The Disciplinary Breakdown of German Morphology, 1870-1900'. *Isis* 78: 365-389.
— (1991): 'Writing Zoologically: The *Zeitschrift für wissenschaftliche Zoologie* and the Zoological Community in Late Nineteenth-Century Germany', in Dear, Peter (ed.): *The Literary Structure of Scientific Argument*. Philadelphia: U. Pennsylvania Press, pp. 43-71.
— (1995): *Biology Takes Form. Animal Morphology and the German Universities, 1800-1900*. Chicago/London: University of Chicago Press.
Ogawa, Mariko (2000): 'Uneasy Bedfellows: Science and Politics in the Refutation of Koch's Bacterial Theory of Cholera'. *Bullettin of the History of Medicine* 74: 671-707.
Olby, Robert (1986): 'Structural and dynamical explanations in the world of neglected dimensions', in Horder, T. J., J. A Witkowski & C. C. Wylie (eds): *A History of Embryology*. Cambridge: CUP, 275-308.
Olesko, Kathryn M. (1993): 'Tacit Knowledge and School Formation'. *Osiris* 8: 16-29.
Omodeo, Pietro (1949): 'Documenti per a storia delle Scienze Naturali al principio del XIX secolo. 1. La vita e le opere di Giosuè Sangiovanni. 2. Manoscritti lamarckiani'. *Bollettino di Zoologia (Torino)* 16: 107-117, 131-137.
— (1996): 'Génération spontanée', in Tort (ed.): *Dictionnaire*, PUF, 1821-4.
— (2001): 'Evoluzionisti italiani nel panorama dell'antropologia illuministica', in Minelli & Casellato (eds.): *Giovanni Canestrini*, pp. 171-188.
O'Neill, John (2003): 'Unified science as political philosophy: positivism, pluralism and liberalism'. *Stud. Hist. Phil. Sci.* 34: 575-596.
Ordish, George (1972): *The Great Blight*. London: Dent.
Orsucci, Andrea (1998): 'Ariani, indogermani, stirpi mediterranee: aspetti del dibattito sulle razze europee (1870-1914)'. *Cromohs* (*Cyber Review of Modern*

Historiography) 3: 1-9, <URL: http://www.unifi.it/riviste/cromohs/3_98/orsucci.html>, last acc. Nov. 2008.
Pagel, [Julius] (1898): 'Geschichte der Medicin und der Krankheiten'. *Jahresbericht über die Leistungen und Fortschritte in der gesammten Medicin* 33.1: 307-341.
Pancaldi, Giuliano (1977): *Charles Darwin: "storia" ed "economia" della natura*. Florence: La nuova Italia.
— (1982): 'Charles Darwin e il pensiero sociale. Alcune prospettive storiografiche recenti'. *Il pensiero politico* 15: 222-230.
— (1983): *Darwin in Italia*. Bologna: Mulino.
— (1991): *Darwin in Italy. Science Across Cultural Frontiers.* (revised translation of Pancaldi 1983 by R. B. Morelli) Bloomington/Indianapolis: Indiana UP.
— (2001): 'Perché non c'è stato un Darwin italiano?', in Minelli & Casellato (eds.): *Giovanni Canestrini*, pp. 189-200.
— (ed., 1983): *I congressi degli scienziati italiani nell'età del positivismo*. Bologna: CLUEB.
— (ed., 1984): *Teleologia e darwinismo. La corrispondenza tra Charles Darwin e Federico Delpino*. Bologna: CLUEB.
— (2003): *Volta. Science and Culture in the Age of Enlightenment*. Princeton: Princeton University Press.
Panceri, Paolo (1873): 'Intorno ad alcune crittogame osservate nell'uovo dello struzzo', in: *Atti della R. Acc. di Scienze Fisiche e Matematiche di Napoli* 6 (reprint 4 pp).
— (1873a): 'La frequenza della sutura frontale negli arabi-egiziani ecc. Lettera del prof. P P. al Prof. Paolo Mantegazza'. *Archivio dell'Antropologia e la Etnologia* 3: 353-72
Panseri, Guido (1981): 'Il medico: note su un intellettuale scientifico italiano nell'Ottocento', in Vivanti, Corrado (ed.): *Storia d'Italia. Annali 4: Intellettuali e potere*. Turin: Einaudi, pp. 1133-1155.
Papa, Emilio R. (ed., 1985): *Il positivismo e la cultura italiana*. Milan: Angeli.
Papini, Giovanni (1903): 'Philosophy in Italy'. *The Monist* 13 (4): 553-585.
Parnes, Ohad (2000): 'The Envisioning of Cells'. *Science in Context* 13: 71-92.
Partsch, Karl Josef (1980): *Die zoologische Station in Neapel. Modell internationaler Wissenschaftszusammenarbeit*. Göttingen: Vandenhoeck & Ruprecht.
Parzinger, Hermann & Janez Dular (1997): 'Die Pfahlbauten des Laibacher Moors (Ljubljansko barje)', in: Schlichtherle (ed.): *Pfahlbauten*, pp. 71-75.
Passerin d'Entrèves, Pietro, & G. Sella Gentile (1985): 'Franco Andrea Bonelli, Zoologo trasformista'. *Studi Piemontesi* 14 (1): 34-48
— (1988): 'L'Accademia delle Scienze di Torino e l'Evoluzionismo', in Anon. (ed.): Tra Società e Scienza. Turin: Allemandi, pp. 148-157.
Passione, Roberta (2007): 'Medical Research and Women's Emancipation, the Case of Giuseppina Cattani', in Babini & Simili (eds.): *More Than Pupils*, pp. 1-25.

Pavesi, Pietro (1905): 'Sul Prof. Cav. Leopoldo Maggi'. *Bollettino dei Musei di Zoologia ed Anatomia comparata di Torino* 20 (489), 8 pp. [Each *Bollettino* is paginated individually]
Pelling, Margaret (1978): *Cholera, Fever and English Medicine 1825-1865*. Oxford: Oxford University Press.
Pensa, Antonio (1913): 'A propos d'une publication de Duesberg "Plastosomen"'. *Anatomischer Anzeiger* 43: 623-624.
— (1991): *Ricordi di vita universitaria*, ed. Bruno Zanobio. Milan: Cisalpino (=*Fonti e studi per la storia dell'Università di Pavia* 15).
Petit, Annie (1995): 'Positivisme, biologie, médecine: Comte, Littré, Robin', in: Panza, Marco, & J.-C. Pont (eds.): *Les savants et l'épistémologie vers la fin du xixe siècle*. Paris: Blanchard, pp. 193-219.
Pilo, Mario (1886): 'Le unità e le pluralità morfologiche (Haeckel, Maggi, Cattaneo)'. *Rivista di filosofia scientifica* 5: 109-115.
Pinna, Giovanni (1991): 'Antonio Stoppani e l'evoluzione', in Daccò, Gian Luigi (ed.): *Antonio Stoppani*, pp. 71-94.
— [ca. 1988]: *Museo Civico di Storia Naturale di Milano 1838-1988: 150 anni di scienza*. Milan: Museo Civico di Storia Naturale.
Poggi, Stefano (1991): *Introduzione a il positivismo*. Rome/Bari: Laterza. [1987]
Pogliano, Claudio (1982): 'Inquietudini della scienza positiva'. *Giornale critico della filosofia italiana* 61 (63): 207-221.
— (1984): 'L'utopia igienista (1870-1920)', in *Storia d'Italia (Einaudi). Annali* 7*: Malattia e medicina*, pp. 589-631.
— (1984a): 'Scienza e stirpe: Eugenica in Italia (1912-1939)'. *Passato e Presente* 5: 61-97.
— (1991): 'La fisiologia in Italia fra Ottocento e Novecento'. *Nuncius* 6 (1): 97-121.
— (1994): 'Discorsi inaugurali nelle facoltà mediche italiane (1875-1925). *Nuncius* 9 (1): 265-294.
— (2000): 'Le scienze biomediche', in A. Casella et al. (eds): *Una difficile modernità. Tradizioni di ricerca e comunità scientifiche in Italia 1890-1940*. Pavia: La Goliardica Pavese, pp. 257-286.
Polenghi, Simonetta (1993): *La politica universitaria italiana nell'età della Destra storica 1848-1876*. Brescia: La Scuola.
Porciani, Ilaria (ed., 1994): *L'Università tra Otto e Novecento: i modelli europei e il caso italiano*. Napoli: Jovene (=Biblioteca di Unistoria 1).
— (2007): 'Disciplinamento nazionale e modelli domestici nel lungo Ottocento: Germania e Italia a confronto', in: Banti, Alberto Mario & Paul Ginsborg (eds): *Storia d'Italia. Annali 22: Il Risorgimento*. Turin: Einaudi, pp. 97-125.
Porro, Alessandro (2001): 'Osteologia, frenologia, craniologia ed antropologia ottocentesche a Milano nei lavori dell'Istituto Lombardo'. *Rivista di storia della medicina* new ser. 11: 45-60.

Provincia Pavese, La (1905): Prof. Leopoldo Maggi/ I funerali del Prof. Leopoldo Maggi/ Inaugurazione dei monumenti a Pavesi e Maggi
Przybylski, H. (1989): Positivismus. In: *Historisches Wörterbuch der Philosophie* 7: P-Q. Basel: Schwabe & Co., col. 1118-1122.
Puccini, Sandra (1985): 'Evoluzionismo e positivismo nell'antropologia italiana (1869-1911)', in Clemente, P., A.R. Leone, S. Puccini (eds.): *L'antropologia italiana, un secolo di storia*. Bari: Laterza (=*Biblioteca di Cultura Moderna* 920), pp. 97-148.
— (1988): 'L'antropologia italiana negli anni di Nicolucci: due inchieste sui caratteri fisici e la psicologia etnica dei popoli italiani (1871-1898)', in Fedele & Baldi (eds.): *Alle origini*, pp. 101-113.
— (ed. 1991): *L'uomo e gli uomini*. Rom: CISU.
Puccioni, Nello (1936): 'Necrologio: Giuseppe Sergi'. *Archivio per l'antropologia e la etnologia* 66: 50-52.
Quadri, Achille (1869): *Note alla Teoria Darwiniana*. Bologna: Vitali.
Quaranta, Mario (1971): 'Positivismo ed hegelismo in Italia', in Geymonat, Ludovico (ed): *Storia del pensiero filosofico e scientifico*. Turin: Einaudi, vol. 5: *Dall'Ottocento al Novecento*, pp. 577-617.
Raffaele, F. (1897): 'Salvatore Trinchese'. *Monitore Zoologico Italiano* 8 (2): 44-46.
Ragusa, Salvatore (2002): 'As time goes by: a profile of Italian acarology', in Bernini, Fabio, e. al. (eds.): *Acarid Phylogeny and Evolution*. Dordrecht: Kluwer, pp 1-20.
Ramberg, Peter J. (2000): 'The Death of Vitalism and the Birth of Organic Chemistry: Wöhler's Urea Synthesis and the Disciplinary Identity of Organic Chemistry'. *Ambix* 47.3: 170-195.
Ranke, Johannes (1900): 'Die überzähligen Hautknochen des menschlichen Schädeldachs'. *Abhandlungen der königlich bayerischen Akademie der Wissenschaften* 20:275-464.
— (1917): 'Dr. Friedrich Hertz: Rasse und Kultur. Leipzig 1915'. *Archiv für Anthropologie* new series 15:73.
Ratcliff, M.J. (2000): 'Wonders, Logic, and Microscopy in the Eighteenth Century: A History of the Rotifer'. *Science in Context* 13: 93-119.
Raynaud, Dominique (1999): 'La correspondance de F.-A. Pouchet avec les membres de l'Académie des Sciences: une réévaluation du débat sur la génération spontanée'. *Archives européennes de sociologie* 40: 257-276.
Rehbock, Philip F. (1975): 'Huxley, Haeckel, and the Oceanographers: The Case of *Bathybius haeckelii*'. *Isis* 66 (234): 504-533.
Reynolds, Andrew (2007): 'The Theory of the Cell State and the Question of Cell Autonomy in Nineteenth and Early-Twentieth Century Biology.' *Science in Context* 20: 71-95.
— (2008): 'Ernst Haeckel and the theory of the cell state: Remarks on the history of a bio-political metaphor'. *History of Science* 46: 123-152.

— (2008a): 'Amoebae as Exemplary Cells: The Protean Nature of an Elementary Organism'. *Journal of the History of Biology* 41: 307-337. Published online: 18 September 2007, DOI 10.1007/s10739-007-9142-8.

Rheinberger, Hans-Jörg (2000): 'Invisible Architectures'. *Science in Context* 13: 121-36.

Richards, Robert J. (2004): 'If This Be Heresy. Haeckel's Conversion to Darwinism', in Lustig, Abigail, Robert J. Richards & Michael Ruse (eds.): *Darwinian Heresies*. Cambridge: CUP, pp. 101-130.

— (2006): 'Ernst Haeckel and the Struggles over Evolution and Religion'. *Annals of the History and Philosophy of Biology* 10: 89-115.

— (2007): 'The Moral Grammar of Narratives in History of Biology. The case of Haeckel and Nazi biology', in Hull, David L. & Michael Ruse (eds.): *The Cambridge Companion to the Philosophy of Biology*. Cambridge: CUP, pp. 429-451.

—. (2007a): 'Ernst Haeckel's Alleged Anti-Semitism and Contributions to Nazi Biology'. *Biological Theory* 2: 97-103.

—. (2008): *The Tragic Sense of Life. Ernst Haeckel and the Struggle over Evolutionary Thought*. Chicago: University of Chicago Press.

Richmond, Marsha (1989): 'Protozoa as Precursors of Metazoa: German Cell Theory and Its Critics at the Turn of the Century'. *Journal of the History of Biology* 22:243-276.

Richmond, Phyllis Allen (1954): 'Some Variant Theories in Opposition to the Germ Theory of Disease'. *Journal of the History of Medicine* 9: 290-303.

— (1954a): 'American attitudes toward the germ theory of disease (1860-1880)'. *Journal of the History of Medicine* 9: 428-454.

Rinard, Ruth (1981): 'The Problem of the Organic Individual: Ernst Haeckel and the Development of the Biogenetic Law'. *Journal of the History of Biology* 14: 249-275.

Röder, Hendrik (2001): Im Reich der Woll- und Schlichthaarigen – Sozialdarwinismus und Eugenik bei Ernst Haeckel, in eid. (eds): *Welträtsel und Lebenswunder. Der Biologe Ernst Haeckel (1834-1919)*. Potsdam: vacat, pp. 59-64.

— & Maren Ulbrich (2001): *Welträtsel und Lebenswunder. Der Biologe Ernst Haeckel (1834-1919)*. Potsdam: Vacat [1998].

Roe, Shirley (1983): 'John Turberville Needham and the Generation of Living Organisms'. *Isis* 74: 159-84.

Rolle, Friedrich (1863): *Ch.s Darwin's Lehre von der Entstehung der Arten im Pflanzen- und Thierreich*. Frankfurt am Main: Hermann.

Roll-Hansen, Nils (1979): 'Experimental Method and Spontaneous Generation: The Controversy between Pasteur and Pouchet, 1859-64'. *Journal of the History of Medicine* 34: 273-93.

— (1983): 'The Death of Spontaneous Generation and the Birth of the Gene: Two Case Studies of Relativism'. *Social Studies of Science* 13: 481-519.

— (1998): 'Pasteur: An Underestimated Hero of Science'. *Centaurus* 40: 81-93.

Romano, Terrie M. (1997): 'The Cattle Plague of 1865 and the Reception of "The Germ Theory" in Mid-Victorian Britain'. *Journal of the History of Medicine and Allied Sciences* 52: 51-80.
Romiti, Guglielmo (1882): 'Lezioni di Embriogenia umana e comparata dei vertebrati'. Siena: Ancora.
Rosa, Daniele (1899): *La riduzione progressiva della variabilità*. Turin: Clausen.
— (1918): *Ologenesi*. Florence: Bemporad.
Rosenberg, Charles (1988): 'Woods or Trees? Ideas and Actors in the History of Science'. *Isis* 79: 565-570.
Rossi, Lino (1986): 'Enrico Morselli al San Lazzaro e nella "Rivista sperimentale di freniatria"', in: Rossi, Paolo (ed.): *L'età del positivismo*. Bologna: Mulino, pp. 379-401.
— (1987): 'Il problema delle degenerazioni umane nell'antropologia psicologica di Giuseppe Sergi', in: Mucciarelli, Giuseppe (ed.): *Giuseppe Sergi nella storia della psicologia e dell'antropologia in Italia*. Bologna: Pitagora, pp. 63-81.
Rossi, Paolo (1977): 'Introduzione', in Fogazzaro, Antonio: *Ascensioni umane*. Milano: Longanesi, pp. 7-44.
Rothschild, Lynn J. (1989): 'Protozoa, Protista, Protoctista: What's in a Name?'. *Journal of the History of Biology* 22:277-305.
Rothschuh, Karl E. (1953): *Geschichte der Physiologie*. Berlin: Springer.
— (1968): *Physiologie. Der Wandel ihrer Konzepte, Probleme und Methoden vom 16. bis 19. Jahrhundert*. Freiburg, München: Alber.
Rovati, Clementina & Paolo Galeotti (eds., 1999): *Il Museo di Lazzaro Spallanzani 1771-1799. Una camera delle meraviglie tra l'Arcadia e Linneo*. Cava Manara (Pavia): Greppi.
— & Carlo Violani (eds., 2005): *Leopoldo Maggi (1840-1905): una lezione per immagine. Catalogo della mostra*. Cava Manara (Pavia): Greppi.
—, Fausto Barbagli & Carlo Violani (2007): 'The waxworks by Angelo Maestri (1806–1889) preserved in the Museum of Natural History of the University of Pavia, Italy'. *Archives of Natural History* 34:259-271.
Rowinski, Paolo (1950): 'Amedeo Herlitzka'. *Archivio di fisiologia* 49: 205-212.
Rudwick, Martin (1997): *Georges Cuvier, Fossil Bones, and Geological Catastrophes*. Chicago: Univ. of Chicago Press.
Ruggeri, Alessandro (ed., 2007): *Luigi Calori: una vita dedicata alla scienza*. Bologna: Medimond.
Rupke, Nicolaas A. (1976): '"Bathybius Haeckelii" and the psychology of scientific discovery: Theory instead of observed data controlled the late 19th century "discovery" of a primitive form of life'. *Studies in History and Philosophy of Science* 7: 53-62.
— (1983): 'The study of fossils in the Romantic philosophy of history and nature'. *History of Science* 21: 389-413.
— (1987): 'Introduction', in idem (ed.): *Vivisection in Historical Perspective*. London: Croom Helm, pp. 1-13.

— (1992): 'Richard Owen and the Victorian museum movement'. *Journal and proceedings of the Royal Society of New South Wales* 125: 133-136.
— (1993): 'Richard Owen's vertebrate archetype'. *Isis* 84: 231-251.
— (1994): *Richard Owen: Victorian Naturalist*. New Haven etc: Yale UP.
— (1994a): 'C. C. Gillispie's *Genesis and Geology*'. *Isis* 85: 261-270.
— (1996): 'Foreword' in Gillispie, Charles Coulston: *Genesis and Geology: A study in the relations of scientific thought, natural theology, and social opinion in Great Britain, 1790-1850*. Cambridge, Mass.: Harvard Univ. Press, v-xix.
— (1999): 'L'Homme est-il le parent du singe?' *Les Cahiers de Science & Vie* 49 (Fév.): 74-82.
— (2000): 'Translation studies in the history of science: the example of *Vestiges*'. *British Journal for the History of Science* 33: 209-222.
— (2002): 'Geology and Paleontology', in Ferngren (ed.): *Science & Religion*, pp. 179-194.
— (2005): *Alexander von Humboldt – A Metabiography*. Frankfurt: Peter Lang.
— (2006): 'Neither Creation nor Evolution: the Third Way in Mid-Nineteenth Century Thinking about the Origin of Species'. *Annals of the History and Philosophy of Biology* 10 (2005): 143-172.
— (2007): 'Introduction: Telling Lives in Science and Religion', in idem (ed.): *Eminent Lives…*, pp. 13-45.
— (ed., 2007): *Eminent Lives in Twentieth-Century Science & Religion*. Frankfurt am Main: Peter Lang.
Rupp-Eisenreich, Britta (1992): 'Le darwinisme social en Allemagne', in: Tort (ed. 1992): *Darwinisme et Société*. Paris: PUF, pp. 169-221.
Ruse, Michael (1996): *Monad to Man*. Cambridge MA: Harvard University Press.
Ruzza, Carlo (2000): 'Language and Nationalism in Italy: Language as a Weak Marker of Identity', in Barbour, Stephen & Cathie Carmichael (ed.s): *Language and Nationalism in Europe*. Oxford: OUP, 168-182.
Samuelson, James (1864): 'On the source of living organisms'. *Quarterly Journal of Science* 1: 598-614.
Sander, Klaus (1991): 'Landmarks in Developmental Biology. Wilhelm Roux and his programme for developmental biology'. *Development, Genes and Evolution* 200: 1-3.
— (1991a): 'Wilhelm Roux and the rest: Developmental theories 1885-1895'. *Development, Genes and Evolution* 200: 297-299.
Sangiorgio, Gaetano (1881): 'Carlo Belgioioso'. *Archivio storico lombardo* 8: 705-712.
Santucci, Antonio (ed., 1982) *Scienza e filosofia nella cultura positivistica*. Milan: Feltrinelli
— (1996): *Eredi del positivismo*. Bologna: Mulino.
Sapp, Jan (2003): *Genesis - The Evolution of Biology*. New York: Oxford University Press.
<http://dx.doi.org/10.1093/acprof:oso/9780195156195.001.0001>

Sarasin, Philipp, et al. (eds., 2007): *Bakteriologie und Moderne. Studien zur Biopolitik des Unsichtbaren, 1870-1920*. Frankfurt am Main: Suhrkamp.
Scarani, Paolo & Alessandro Ruggeri (2007): 'Luigi Calori e la questione delle razze umane: una presa di posizione fuori dal corso', in Ruggeri (ed.): *Luigi Calori*, pp. 95-102.
Scarpelli, Giacomo (1990): 'Scimmie e fantasmi. Teorie dell'evoluzione tra positivismo, spiritualismo e spiritismo'. *Intersezioni* 10: 297-317.
Schaaffhausen, [Hermann] (1865): 'Über die Urzeugung', in Wernher & Leuckart (eds.): *Amtlicher Bericht über die neun und dreißigste Versammlung deutscher Naturforscher und Ärzte in Gießen im September 1864*. Gießen: Keller, pp. 183-186.
Scharf, J.-H. (1990): 'Krisen der Cytologie'. *Acta histochemica* Suppl. 39:11-47.
Schenk, G. (1991): 'Positivismus', in: Hörz e.al. (eds.): *Philosophie und Naturwissenschaften* , pp. 726-729.
Schimper, A.F.W. (1883): 'Über die Entwicklung der Chlorophyllkörner und Farbkörper'. *Botanisches Zentralblatt* 41: col. 105-112, 121-131, 137-146, 153-163, plate 1.
Schirru, Damiana (2005): 'Uomo e natura nel monismo evoluzionistico di Enrico Morselli', in Frigo, Gian Franco & Olaf Breidbach (eds.): *Scienza e filosofia nel positivismo italiano e tedesco*. Padua: Poligrafo, pp. 187-198.
Schlegel, Martin & Klaus Hausmann (eds., 1996): *Christian Gottfried Ehrenberg-Festschrift*. Leipzig: Univ.-Verlag.
Schleicher, Aug[ust] (1863) *Die Darwinsche Theorie und die Sprachwissenschaft. Offenes Sendschreiben an Herrn Dr. Ernst Häckel* [...]. Weimar: Böhlau, 29 pp.
Schlichtherle, Helmuth (ed. 1997): *Pfahlbauten rund um die Alpen*. Stuttgart: Theiss (*Archäologie in Deutschland* special issue).
Schmidt, Heinrich (1926): *Ernst Haeckel*. Berlin: Deutsche Buchgemeinschaft.
Schmiedebach, Heinz-Peter (1993): 'Pathologie bei Virchow und Traube. Experimentalstrategien in unterschiedlichem Kontext', in Rheinberger, Hans-Jörg & Michael Hagner (eds.): *Die Experimentalisierung des Lebens*. Berlin: Akademie, pp. 116-134.
Schmitt, J[oseph] (1886): *Microbes et Maladies*. Paris: Baillière.
Secord, James A. (1989): 'Extraordinary Experiment: Electricity and the Creation of Life in Victorian England', in Gooding, Pinch, Schaffer: *The Uses of Experiment*. CUP, 337-383.
Sergi, Giuseppe (1898): 'The Aryans and the ancient Italians'. *The Monist* 8: 161-182.
— (1899): 'The primitive inhabitants of Europe'. *The Monist* 9: 321-344.
— (1899): 'The Man of Genius'. *The Monist* 10: 85-115.
— (1900): *Specie e varietà umane*. Torino: Bocca.
— (1901): 'Some ideas concerning biological heredity'. *The Monist* 12: 1-20.
— (1902): 'Mediterranean culture and its diffusion in Europe'. *The Monist* 12: 161-180.
— (1904): 'Primitive Rome'. *The Monist* 16: 161-176.

— (1906): *Fatti e pensieri di Coltura e Politica sociale*. Milan: Casa Editrice Moderna

Servos, John W. (1993): 'Research Schools and Their Histories'. *Osiris* 8: 3-15.

Shapin, Steven & Arnold Thackray (1974): 'Prosopography as a Research Tool in History of Science: The British Scientific Community 1700-1900'. *History of Science* 12: 1-28.

Shortland, Michael & Richard Yeo (eds. 1996): *Telling Lives in Science*. Cambridge: Cambridge University Press.

Signori, Elisa (2000): 'Le leggi razziali e le comunità accademiche. Casi, problemi, percorsi nel contesto lombardo', in Casella, Antonio, & al (eds): *Una difficile modernità. Tradizioni di ricerca e comunità scientifiche in Italia 1890-*1940. Pavia: La Goliardica, pp. 431-486.

Sitte, Peter (1982): 'Die Entwicklung der Zellforschung'. *Berichte der Deutschen Botanischen Gesellschaft* 95: 561-580.

— (ca. 1994): 'Das goldene Zeitalter der Zellbiologie', in: Braune, W., E. Krauße & P. Sitte (eds.): *Festschrift Eduard Strasburger, 1844-1912*. Jena: Universitätsverlag, pp. 39-61.

Smit, P. (1968): 'Ernst Haeckel and his „Generelle Morphologie"'. *JANUS* 54: 236-252.

Sober, Elliott & Steven Hecht Orzack (2003): 'Common Ancestry and Natural Selection'. *Brit. J. Phil. Sci.* 54: 423-437.

Söderqvist, Thomas (2003): 'Wissenschaftsgeschichte à la Plutarch. Biographie über Wissenschaftler als tugendethische Gattung', in Bödeker (ed.): *Biographie schreiben*, pp. 285-325.

— (ed., 2007): *The History and Poetics of Scientific Biography*. Aldershot: Ashgate.

Sole, Francesco (1881): *Il positivismo*. Napoli: Morano.

Soury, Jules (1880): 'Préface du traducteur', in Haeckel. Ernest: *Essais de psychologie cellulaire*. Paris: Germer Baillière. XXIX pp.

Spedini, Gabriella (1987): 'Il processo di rinnovamento dell'Antropologia con Giuseppe Sergi', in Mucciarelli, Giuseppe (ed.): *Giuseppe Sergi nella storia della psicologia e dell'antropologia in Italia*. Bologna: Pitagora, pp. 105-116.

— (1990): 'L'evoluzione del concetto biologico di razza'. *Rivista di antropologia (Roma)* 68: 37-50.

Spee, F. Graf von (1896): 'Kopf', in Bardeleben, Karl von (ed.): *Handbuch der Anatomie des Menschen*, vol. 1 (*Skeletlehre*) part 2, pp. 93-372.

Spengel, J. W. (1872): *Die Darwinsche Theorie. Verzeichniss der über dieselbe in Deutschland, England, Amerika, Frankreich, Italien, Holland, Belgien und den Skandinavischen Reichen erschienenen Schriften und Aufsätze*. Berlin: Wiegandt und Hempel.

Stapfia 56 (1998): Welträtsel und Lebenswunder. Ernst Haeckel - Werk, Wirkung und Folgen. Linz: OÖ Landesmus.

Steffen Gerber, Therese (2005): 'Brunner [-von Wattenwyl], Carl', in *Historisches Lexikon der Schweiz (HLS)*, URL: http://www.hls-dhs-dss.ch/textes/d/D28793.php.

Sternhell, Zeev (1976): 'Fascist Ideology', in Laqueur, Walter (ed.): *Fascism. A Reader's Guide*. Berkeley/LA: Univ. Cal. Pr, 315-376.
— (1986): *Neither Right nor Left. Fascist Ideology in France*. Berkeley etc.: UCP.
Stieda, Hermann (1892): 'Die Anomalien der menschlichen Hinterhauptsschuppe'. *Anatomische Hefte* 4 (=2.1): 59-107.
Strahm, Christian (1997): 'Chronologie der Pfahlbauten', in: Schlichtherle (ed.): *Pfahlbauten*, pp. 124-126.
Strick, James E. (1999): 'Darwinism and the Origin of Life: The Role of H.C. Bastian in the British Spontaneous Generation Debates', 1868-1873. *Journal of the History of Biology* 32: 51-92.
— (2000): *Sparks of Life. Darwinism and the Victorian Debates Over Spontaneous Generation*. Cambridge MA/London: Harvard UP.
Stroud, Patricia Tyson (2000): *The Emperor of Nature : Charles-Lucien Bonaparte and his world*. Philadelphia: Univ. Philadelphia Press.
Sturdy, Steve (1991): 'The Germs of a New Enlightenment. Review of Latour: *The Pasteurization of France*'. *Stud. Hist. Phil. Sci.* 22 (1): 163-173.
Szöllösi-Janze, Margit (1998): *Fritz Haber (1868-1934), eine Biographie*. München: Beck.
Taramelli, T[orquato] (1883): 'Commemorazione di Giuseppe Balsamo-Crivelli'. *Rendiconti. R. Istituto Lombardo di Scienze, Lettere e Arti*, serie 2, vol. 16: 888-898.
Taylor, P. M. (1987): 'Paolo Mantegazza (1831-1910): Reassessing the Florentine School of Anthropology in Pre-Fascist Italy (upto 1925)'. *Antropologia contemporanea* 10 (1-2): 1-16.
— (1988): 'Anthropology and the "Racial Doctrine" in Italy before 1940'. *Antropologia contemporanea* 11 (1-2): 45-58.
Tega, Walter (ed. 1985): *L'anno di Darwin. Problemi di un centenario*. Parma: Pratiche.
Tentori, Tullio (1988): 'Cultori di scienze antropologiche in Italia tra la fine dell'Ottocento e gli inizi del Novecento', in: Fedele & Baldi (eds.): *Alle origini*, pp. 85-99.
Théodoridès, Jean (1972): 'État des connaissances sur la structure des Protozoaires avant la formulation de Théorie cellulaire'. *Revue d'histoire des sciences* 25: 27-44.
Thomann, Klaus-Dieter, & Werner Kümmel (1995): 'Naturwissenschaft, Kapital und Weltanschauung. Das Kruppsche Preisausschreiben und der Sozialdarwinismus'. *Medizinhistorisches Journal* 30: 99-143, 205-243, 315-352.
Tomes, Nancy J. (1998): *The Gospel of Germs: Men, Women, and the Microbe in American Life*. Cambridge, Mass.: Harvard University Press.
— & John Harley Warner (1997): 'Introduction to Special Issue on Rethinking the Reception of the Germ Theory of Disease: Comparative Perspectives'. *Journal of the History of Medicine and Allied Sciences* 52: 7-16.

— (1997): 'American Attitudes toward the Germ Theory of Disease: Phyllis Allen Richmond Revisited'. *Journal of the History of Medicine and Allied Sciences* 52: 17-50.
Tort, Patrick (ed. 1996): *Dictionnaire du darwinisme et de l'évolution*. Paris: Presses Universitaires de France, 1996 [3 vols, page numbers continuous].
Toscano, Mario (1986): 'Gli ebrei in Italia dall'emancipazione alle persecuzioni'. *Storia contemporanea* 17 (5): 905-954.
Troiani, Diana & Ermanno Manni (2007): 'A tribute to Italian physiologists of Jewish descent evicted during the persecution ordered by the Fascist Regime in 1938'. *Advances in Physiology Education* 31:123-128.
Trostle, James (1986): 'Early work in anthropology and epidemiology: from social medicine to the germ theory, 1840 to 1920', in Janes, Craig R. et al. (eds.): *Anthropology and Epidemiology*. Dordrecht: Reidel, pp. 35-57.
Uschmann, Georg (1976): 'Über die Beziehungen zwischen Albert Koelliker und Ernst Haeckel'. *Wissenschaftliche Zeitschrift der FSU Jena, Math.-Nat. R.* 25 (2): 125-132.
— (1979): 'Haeckel's Biological Materialism'. *History and Philosophy of the Life Sciences* 1: 101-118.
— (ed., 1983): *Ernst Haeckel. Biographie in Briefen*. Leipzig etc.: Urania.
— (1985): 'Das Werk Ernst Haeckels: Voraussetzungen und Bedingtheiten', in Wilhelmi, Bernd (ed.): *Leben und Evolution*. Jena: Friedrich-Schiller-Universität, pp. 32-39.
Vaccari, Ezio (2002): 'Gli studi geologici di Maggi tra lavoro di ricerca e attività didattica', in Armocida et al. (eds.): *Leopoldo Maggi*, pp. 35-47.
[Vallada e. al.] (1883): *Del dogmatismo scientifico dell'illustre prof. Pasteur e dell'uso che se ne può fare*. Turin: Bruno.
Vallery-Radot, Pasteur (1922): *Œuvres de Pasteur*. Vol. 2: *Fermentations et générations dites spontanées*. Paris: Masson.
Vernon, Keith (1990): 'Pus, sewage, beer, and milk: microbiology in Britain, 1870-1940'. *History of Science* 28: 289-325.
Vidoni, Ferdinando (1993): *Il Positivismo*. Napoli: Morano.
Vignoli, Tito (1892): 'Carlo Darwin ed il Pensiero', in Morselli, Enrico (ed.): *Carlo Darwin e il Darwinismo nelle Scienze Biologiche e Sociali. Scritti vari di G. Canestrini, G. Cattaneo, A. Loria, G. Marinelli, E. Morselli, G. Romiti, G. Tarozzi, G. Trezza e T. Vignoli*. Milano: Dumolard, pp. 189-196.
Villa, Renzo (1985): *Il deviante e i suoi segni*. Milan: Angeli.
Violani, Carlo (2002): 'Alcuni aspetti zoologici nell'opera di Leopoldo Maggi', in Rovati & id. (eds.): *Leopoldo Maggi*, pp. 49-56.
Virchow, Rudolf (1877): *Die Freiheit der Wissenschaft im modernen Staat*. Berlin: Wiegandt, Hempel & Parey.
Visconti, Agnese (1988): *I 150 anni del Museo Civico di Storia Naturale di Milano (1838-1988)*. Milan: Museo Civico di Storia Naturale.
Vivarelli, Roberto (1991): 'Interpretations of the Origins of Fascism'. *Journal of Modern History* 63: 29-43.

Walther, Johannes (1919): ‚Ernst Haeckel als Mensch und Lehrer'. *Die Naturwissenschaften* 17: 946-951.
Warner, Deborah Jean (1995): 'The Campaign for Medical Microscopy in Antebellum America'. *Bulletin of the History of Medicine* 69: 367-386.
Warner, John Harley (1995): 'The history of science and the sciences of medicine'. *Osiris* new ser. 10: 164-193.
Weber, Heiko (2000): *Monistische und antimonistische Weltanschauung. Eine Auswahlbibliographie*. Berlin: vwb (Ernst-Haeckel-Haus-Studien 1).
Wedekind, Kurt (1976): 'Die Frühprägung Ernst Haeckels'. *Wissenschaftliche Zeitschrift der FSU Jena, Math.-Nat. R.* 25 (2): 133-148.
Weikart, Richard (1993): 'The Origins of Social Darwinism in Germany, 1859-1895'. *Journal of the History of Ideas* 54: 469-488
— (2004): *From Darwin to Hitler: Evolutionary Ethics, Eugenics, and Racism in Germany*. Basingstoke: Palgrave Macmillan.
Weiler, Bernd (2006): *Die Ordnung des Fortschritts. Zum Aufstieg und Fall der Fortschrittsidee in der "jungen" Anthropologie*. Bielefeld : transcript.
Weindling, Paul (1989): 'Ernst Haeckel, Darwinismus and the secularization of nature', in James R. Moore (ed.): *History, Humanity, and Evolution*. Cambridge: Cambridge University Press.
— (1998): 'Dissecting German Social Darwinism: Historicizing the Biology of the Organic State'. *Science in Context* 11 (3-4): 619-637.
Weingart, Peter (1993): 'Science Abused? Challenging a Legend'. *Science in Context* 6: 555-567.
—, Jürgen Kroll & Kurt Bayertz (1988): *Rasse, Blut und Gene. Geschichte der Eugenik und Rassenhygiene in Deutschland*. Frankfurt: Suhrkamp.
Wiedersheim, Robert (1893): *Der Bau des Menschen als Zeugniss für seine Vergangenheit*. Freiburg: Mohr [based on a homonymous paper published in 1887 in the *Berichte der Naturforschenden Gesellschaft zu Freiburg*]
Winau, Rolf (1981): 'Ernst Haeckels Vorstellungen von Wert und Werden menschlicher Rassen und Kulturen'. *Medizinhistorisches Journal* 16: 270-279.
Woolf, Stuart (2003): On University Reform in Italy'. *Minerva* 41: 347-363.
Worboys, Michael (1991): 'Germ Theories of Disease and British Veterinary Medicine 1860-1890'. *Med. Hist.* 35: 308-327.
Zampieri, Fabio (2006): *Storia e origini della medicina darwiniana*. n.l.: Mattioli 1885.
Zängl-Kumpf, Ursula (1990): *Hermann Schaaffhausen. Die Entwicklung einer neuen physischen Anthropologie im 19. Jahrhundert*. Frankfurt am Main: Fischer.
Zanobio, Bruno (1994): 'La Società Medico-chirurgica di Pavia nel centenario della fondazione', in Cimino, Guido, & Carlo Maccagni (eds 1994): *La storia della medicina e della scienza tra archivio e laboratorio*. Florence: Olschki, pp. 139-149.
Zavattari, Edoardo (1934): 'Maggi, Leopoldo', in: *Enciclopedia Italiana* 21: 886. Roma: Treccani.
Ziehen, Th. (1919): Haeckel als Philosoph. *Die Naturwissenschaften* 17: 958-961.

Zoja, Luigi & Raffaello Zoja (1891): 'Intorno ai plastiduli fucsinofili (Bioblasti dell'Altmann)'. *Memorie del R. Istituto Lombardo di Scienze, Lettere e Arti, Cl. Scienze* 16: 237-270.
Zoja, Louis & Raphael Zoja (1891a): 'Ueber die fuchsinophilen Plastidulen (Altmann's Bioblasten).' *Archiv für Anatomie und Physiologie. Anatomische Abteilung* 15: 335-351.
Zuppinger, Hans (1974): *Albert von Kölliker (1817-1905) und die mikroskopische Anatomie*. Diss. Zürich. (=*Zürcher Medizingeschichtliche Abhandlungen*, N.R. 101).

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Rainer Brömer: Plastidules to Humans

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DEUTSCHE
GESELLSCHAFT
FÜR GESCHICHTE
UND THEORIE
DER BIOLOGIE

The name DGGTB (Deutsche Gesellschaft für Geschichte und Theorie der Biologie; German Society for the History and Philosophy of Biology) reflects recent history as well as German tradition. The Society is a relatively late addition to a series of German societies of science and medicine that began with the „Deutsche Gesellschaft für Geschichte der Medizin und der Naturwissenschaften", founded in 1910 by Leipzig University's Karl Sudhoff (1853-1938), who wrote: „We want to establish a ‚German' society in order to gather German-speaking historians together in our special disciplines so that they form the core of an international society...". Yet Sudhoff, at this time of burgeoning academic internationalism, was „quite willing" to accommodate the wishes of a number of founding members and „drop the word German in the title of the Society and have it merge with an international society". The founding and naming of the Society at that time derived from a specific set of historical circumstances, and the same was true some 80 years later when in 1991, in the wake of German reunification, the „Deutsche Gesellschaft für Geschichte und Theorie der Biologie" was founded. From the start, the Society has been committed to bringing studies in the history and philosophy of biology to a wide audience, using for this purpose its Jahrbuch für Geschichte und Theorie der Biologie. Parallel to the Jahrbuch, the Verhandlungen zur Geschichte und Theorie der Biologie has become the by now traditional medium for the publication of papers delivered at the Society's annual meetings. In 2005 the Jahrbuch was renamed Annals of the History and Philosophy of Biology, reflecting the Society's internationalist aspirations in addressing comparative biology as a subject of historical and philosophical studies.

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